AUSTRALIA IN THE WAR OF 1939-1945

SERIES FIVE
MEDICAL

VOLUME III
THE ISLAND CAMPAIGNS

AUSTRALIA IN THE WAR OF 1939-1945

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THE ISLAND CAMPAIGNS

by

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M.D., Ch.M., F.R.A.C.P.

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"To live is to achieve a perpetual triumph; it is to assert oneself against destruction, against sickness, against the annulling and dispersion of one's physical and moral being."

(H. F. Amiel)

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ABBREVIATIONS

A.A.C.C.—Australian Army Catering Corps.
A.A.M.C.—Australian Army Medical Corps.
A.A.M.W.S.—Australian Army Medical Women's Service.
A.A.N.S.—Australian Army Nursing Service.
A.A.S.C.—Australian Army Service Corps.
A.D.G.M.S.—Assistant Director-General Medical Services.
A.D.M.S.—Assistant Director Medical Services.
A.D. of H.—Assistant Director of Hygiene.
A.D.S.—Advanced Dressing Station.
A.G.H.—Australian General Hospital.
A.I.F.—Australian Imperial Force.
A.M.C.U.—Australian Malaria Control Unit.
A.M.D.—Army Medical Directorate.
A.M.F.—Australian Military Forces.
Angau—Australian New Guinea Administrative Unit.
A.R.C.S.—Australian Red Cross Society.
A.S.P.—Ambulance Staging Post.

B.M.A.—British Medical Association.
B.T.—Benign Tertian (malaria).

C.C.S.—Casualty Clearing Station.
C.M.C.C.—Central Medical Coordination Committee.
C.O.S.C.—Combined Operational Service Command.
C.S.I.R.—Council for Scientific and Industrial Research.

D.A.D.H.—Deputy Assistant Director Hygiene.
D.A.D.M.S.—Deputy Assistant Director Medical Services.
D.D.M.S.—Deputy Director Medical Services.
D.D.T.—Dichloro-diphenyl-trichlorethane.
D.G.M.S.—Director-General Medical Services.
D.I.D.—Detail Issuing Depot.
*D.P.*1—Draft Priority 1.
D.R.S.—Divisional Rest Station.
D.U.K.W.—Amphibious powered vehicles.

E.P.I.P. Tent—European Privates Indian Pattern Tent.

Fd. Amb.—Field Ambulance.

G.O.C.—General Officer Commanding.
G.R.O.—General Routine Order.

H.Q.—Headquarters.

L.C.A.—Landing Craft, Artillery.
L.C.M.—Landing Craft, Mechanised.
L.C.T.—Landing Craft, Tank.
L.C.V.—Landing Craft, Vehicle.
L.C.V.P.—Landing Craft Vehicle—Personnel.
L.S.I.—Landing Ship, Infantry.
L.S.T.—Landing Ship, Tank.

M.B.D.S.—Main Beach Dressing Station.
M.D.S.—Main Dressing Station.
M.E.C.C.—Medical Equipment Control Committee.
M.S.P.—Medical Staging Post.
M.T.—Malignant Tertian (malaria).

N.C.O.—Non-Commissioned Officer.
N.G.I.B.—New Guinea Infantry Battalion.
N.G.V.R.—New Guinea Volunteer Rifles.

O.R.—Other rank.

P.I.B.—Papuan Infantry Battalion.
P.O.W.—Prisoners of War.
P.U.O.—Pyrexia of unknown origin.

Q Branch—Quartermaster-General's Branch.

R.A.A.F.—Royal Australian Air Force.
R.A.E.—Royal Australian Engineers.
R.A.N.—Royal Australian Navy.
R.A.P.—Regimental Aid Post.
R.M.O.—Regimental Medical Officer.

S.A.T.—Sea Ambulance Transport.
S.B.—Stretcher Bearer.
S.M.O.—Senior Medical Officer.
S.W.P.A.—South-West Pacific Area.

W.E.—War Establishment.
W.O.—Warrant Officer.

PREFACE

THIS volume is the second of two describing the operational experiences of the Australian Army Medical Corps during the war of 1939-45. In the previous volume, *Middle East and Far East,* the narrative, having traced the return of the I Australian Corps to Australia, passed on to the frustrate actions in Malaya and in the chain of islands stretching from Sumatra to Timor. Here the proximity of Northern Australia to these events gave warning of the dangers that might lie to the north of the island continent, but between Australia and an enemy from the north lay the bulk of New Guinea. This large island with its vast variety of country and people was already closely linked with the destiny of Australia, and in the coming struggle was evidently to be the proving ground of the Japanese and the Allied American and Australian forces.

In *Middle East and Far East* the story swept on past New Guinea, the Solomons and other islands and followed the fate of the prisoners of war scattered over the eastern zones of conflict. We now return to New Guinea and other related areas and fill the gap in the medical records that we previously left, telling the story of hard striving against a stubborn foe, and a constant fight against tropical disease in a wild and formidable terrain. The medical narrative deals largely with the topic of preventive medicine, never absent from the mind of the administrator, who is ever alert to the man-wastage wrought by the forces of nature. It further deals with the effects of the violence of war on the fighting men, and tells how the medical services strove always to lessen this wastage by methods that had a constant background of science, and yet were interwoven with all the extemporisations that ingenuity could compass.

With so many medical units engaged in work in the field, in training and in rehabilitation, the scope of the New Guinea story has widened, and thus its scale will permit only a somewhat lessened degree of personal detail, which hardly gives these actors in the medical history the appreciation they merit. It is hoped, however, that a presentation which lays emphasis on the work of the units of the Australian Army Medical Corps, as well as that of individuals, will produce a more compact narrative, on which a brighter light shows up the outstanding achievements.

Administration is treated in only moderate detail, and one chapter is devoted to some of the most important problems arising in Australia during the last vital years of the war.

Post-war activities, as in preceding volumes, are not dealt with except in occasional faint outline, and for this reason little is said of the excellent work carried out by members of medical units on repatriates and prisoners of war.

All the chapters and sections of this volume have been submitted to medical officers whose experience enabled them to correct and criticise the facts and opinions which make up the text of the story. I am grateful for the interest and assistance given by these colleagues, especially in

parts of the history where records were meagre, by reason of the nature of the episodes they describe. I have had free access to the available records, and take the responsibility for the presentation of this phase of the medical history and the opinions expressed.

I am specially indebted to Mr Gavin Long, the General Editor, for his advice and help, and for the assistance of his staff in correction of drafts dealing with matters outside the scope of a medical writer. My part-time assistants have been particularly helpful during the past year, during which removal of the medical history's headquarters from Canberra to Sydney increased our difficulties. The work of Mrs Evelyn East as research assistant has been invaluable in all phases of compilation of this book. Mrs Gladys Pope promptly and efficiently carried out the majority of the typing and secretarial work in Canberra. Mr H. W. Groser, the cartographer of the War History, has again made the maps a most valuable adjunct to the text. Mrs Gwen Jacobson wrote the index.

Major-General F. Kingsley Norris, D.G.M.S., and the members of his staff have again been most cooperative and helpful. Major J. J. McGrath, Director of the Australian War Memorial, and his staff in Canberra and Sydney have also assisted us to obtain and hold relevant records, and to use official photographs.

I am again grateful to Dr Mervyn Archdall, Editor of *The Medical Journal of Australia,* and Dr R. R. Winton, the Assistant Editor, for reading and criticising the typescript. Lastly, the friendly cooperation and encouragement of numbers of my medical colleagues have often been a great uplift in the task of compiling a medical war history.

A.S.W.

Sydney, 28th September 1954.

CHAPTER 1

WAR THREATENS MORESBY

DECEMBER 1941 was the most fateful month for Australia since the outbreak of war in September 1939. The rapid and repeated blows of the Japanese in the Pacific and the Far East brought the threat of war to the immediate environment of Australia, and as was believed at that time, even the imminent risk of invasion. These dangers had been foreseen and measures had been taken to establish some defence organisation, at Rabaul and Port Moresby in particular. From the medical point of view both these centres were of great potential importance; therefore it is of interest to see how medical matters stood in the Territories of New Guinea and Papua during 1941.

Moresby was the most important centre in the Territory of Papua, which was under the control of the Commonwealth of Australia, though not included in it. Nationally the whole island of New Guinea was subdivided into a western and northern half, Dutch New Guinea, while the remainder comprised a northern and eastern part, the Mandated Territory of New Guinea, and a southern and eastern part, the Territory of Papua. After the 1914-18 war the northern portion had passed from the control of Germany, and came under the Mandate of Australia.[1]

Rabaul, in New Britain, had the status of the political capital of the Mandated Territory, and as an important outpost, was reinforced with troops in March 1941. Major-General R. M. Downes, as D.G.M.S., approached Dr E. T. Brennan, Senior Health Officer of the Department of Health in the Rabaul Civil Administration, for cooperation in the care of men who might need hospital treatment. Brennan's help was freely given, and his extensive tropical experience was of great value. The Rabaul force was of course self-contained and could supply all the ordinary medical care likely to be needed by a defence organisation.

Early in 1941 both a military and a civil administration existed in Port Moresby. The area was the 8th Military District, and the medical care of Moresby depended on the medical officers of the 9th Fortress Company and the 49th Battalion. In addition to the early attention to the defence of Rabaul, the strategic importance of Moresby was realised, and Downes inspected the medical arrangements personally, and had detailed reports made by several of his staff. Even at a time when war in the Pacific had not become a reality, and when the defence of Australia was not so urgent as it later became, an important principle was established that Australia would need a safe tropical base in the event of war in the islands. Further, no such base could be safe unless endemic diseases were controlled, and of these by far the most important was malaria. Though Moresby was in the tropics it was situated in a dry area, with

[1] During military operations in the South-West Pacific the name "New Guinea" was commonly used to denote any part of these Territories.

a rainfall of less than forty inches a year, derived largely from the north-west monsoon between December and April. The infectious diseases occurring in the area included malaria, scrub typhus, hookworm and dysentery. Tropical ulcer and yaws occurred among natives, who also suffered from dietetic deficiencies, chiefly beriberi. By earnest application of preventive measures it was a healthy area, at least under the easier conditions of peaceful civil life; it had a good harbour, and was close to the Australian mainland. Moresby, if well controlled under conditions of military occupation, was thus eminently suitable as a base for Australia in the event of operations in the South-West Pacific.

HEALTH CONDITIONS IN NEW GUINEA

At the request of Major-General Downes, the Acting Director of Public Health in Rabaul had drawn up in 1937 a survey of the medical and hygienic aspects of the Territory of New Guinea. The technical staff of the department then numbered seventy-four, ranging from medical practitioners to lay medical assistants. The administration cared for the health of both European and native nationalities, though the hospital accommodation for the latter was somewhat primitive. Food resources were relatively small, and most European foods were imported. Adequate vitamins were contained in the diet scales for native labourers. There was an ample supply of water, and sanitation of conservancy type was established in settled centres.

Dysentery was not uncommon, though usually mild. It was predominantly of the Flexner type, and was carried by flies and possibly sometimes by water. The mild nature of the local disease encouraged carelessness, which was responsible for occasional outbreaks.

The most important endemic disease was malaria, which was widespread throughout the Territory. High spleen rates were found among the native children, and the proximity of native villages to some areas, in particular Moresby, tended to offset the value of prophylactic measures. Quinine was used perfunctorily as a suppressive, and since the subtertian type was common, and civilians usually treated recurrent attacks with only moderate dosage of quinine, blackwater fever was not a negligible risk. Some of the residents claimed that they acquired a relative immunity to malaria, but such a degree of resistance as was established varied with locality, owing no doubt to the existence of different strains of the parasite.

In March 1941 Downes arranged for huts to be used for a temporary hospital while a building was erected, and medical and nursing staffs were increased. In May the fortress troops numbered some 1,080: their health was cared for by four medical officers, and sick could be treated in a hut in the 49th Battalion lines and in the civil hospital, where the cooperation of a devoted Australian civilian nursing staff was very much appreciated. The R.A.A.F. had its own sick quarters.

Later in the year Colonel M. J. Holmes, Director of Pathology and Hygiene at Army Headquarters, reported that there had been a high rate

of sickness during the year, chiefly due to malaria, dysentery and dengue. Heavy anopheline breeding and high infection rates in native villages made a certain incidence of malaria inevitable. Active control measures were taken so far as possible with the limited labour available; valuable help in this regard was given by the civil administration. The appointment of a pathologist assisted greatly in diagnosis and control. Special measures were also inaugurated to control the *Aedes* responsible as a vector of dengue, since the habits of this mosquito called for a different attack to that used for the *Anopheles*. As further reinforcements were added to the force in Moresby the need for more direct army control of hygiene was felt.

Lieut-Colonel E. L. Cooper, assistant to the D.G.M.S., after an inspection reported that additions to the administrative staff were required. In assessing such needs the incidence of malaria was a good index, having in mind the entirely different aspects of malaria in a small civilian community in times of peace, and malaria in a non-immune military force which might at any time be committed to action. Though the malarial position had improved considerably in Moresby, fresh infections were still occurring in the area at the end of the monsoonal rains. Cooperation was good between the civil and military authorities, but in spite of this it could be seen that greater efficiency would result from unified control, particularly when the forces in New Guinea attained a greater size.

DEFENCE IN AUSTRALIA

In Australia during the latter part of 1941 home defence was in the forefront of planning. There was much to be done, and in August little more than one-quarter of the militia force was on full-time service; training was discontinuous and military equipment was limited, though Australia was still contributing some armaments to Allies. A Volunteer Defence Corps was organised, and provision was made for coastal defence and watching services. The question of command of the home forces caused some argument, and Lieut-General Sir Iven Mackay, who was appointed, found that the extent of his authority and command was restricted. Six divisions were envisaged as a mobile force for the defence of the important vulnerable areas on the eastern coast, and an armoured division, part of an armoured corps, was being formed and trained. In addition, the Government insistently stressed the great demands of manpower and material needed for wartime projects. By contrast with this spacious planning, for which incidentally the medical needs would be considerable, only small defence forces could be spared to send to the islands ringing Australia on the north and east. However, it was evident that the defenders of Australia would be fighting in the tropics, and responsible officers of the medical services were well aware that persistent endeavours would be needed to prevent the forces of nature from dangerously thinning the ranks of the fighting men. General medical organisation was furthered by bringing all the medical affairs of the 8th Military District under control

of the army: Lieut-Colonel E. T. Brennan was appointed A.D.M.S. on 23rd December 1941 and Major A. J. Foote, D.A.D.M.S.

WAR COMES CLOSER

January 1942 brought about a very difficult state of affairs in the Moresby area. The first few days of the month saw a strong Japanese attack on Rabaul, and before the month was out New Britain was held by the enemy. Events were ominous in Malaya, where the ability of the defenders to stem the Japanese invasion was already doubtful. In Timor and Ambon the defence forces were over-run, though Independent Companies in Timor were able for some considerable time to harass the occupying Japanese.

These events were reflected in the arrival of reinforcements in Moresby; the fall of Rabaul in particular brought the danger closer to the mainland and it was evident that Moresby was fast becoming a vital base. The increased number of Australian troops required more medical attention and more medical units were sent to the Moresby area.

ARMY MEDICAL UNITS IN MORESBY

The first of these medical units to arrive was the 3rd Field Ambulance, under Lieut-Colonel N. S. Gunning; this unit after hasty equipment and preparation left Adelaide on Christmas Day and occupied quarters in Murray Barracks, Moresby, on 3rd January. Nothing was prepared for the unit, some of whose members were immediately set to work on roads in the hospital area of the barracks, while others obtained and moved stores, and dug slit trenches.

The only other military medical service available was that of the "base hospital" of the 8th Military District, then in Murray Barracks under Captain W. E. King, who was shortly promoted major. Dysentery soon broke out among the troops and the base hospital was quite inadequate to house the sick. Therefore "B" Company of the 3rd Ambulance under Major J. R. Cornish set up a dysentery hospital several miles from the barracks. Conditions here were very primitive: there were no beds at first, patients slept on the ground on blankets and ground-sheets, tentage was very meagre, there were no nets, nor was there any supply of running water. Major W. R. C. Morris set up an A.D.S. across Napa Napa Bay for evacuating patients from the 53rd Battalion, and the M.D.S. was established at Murray Barracks to supply local requirements. These moves, completed on the 9th, supplied a real need, for by the end of the month nearly 200 men were in hospital with dysentery, and the M.D.S. was treating some 100 patients per day.

Air raids begin. On the night of 3rd February the Japanese attacked Moresby from the air: this was the first of over 100 air raids observed by the 3rd Field Ambulance while in Moresby. Only slight damage was done on this occasion. Daylight raids were begun three weeks later, and thereafter air attacks increased in intensity until later when vigorous and effective counter-measures became possible.

ADMINISTRATIVE CHANGES

On 11th February the general administration of the Territory of New Guinea and of Papua was simplified by the suspension of the civil administration of both territories; as from the 12th military control was instituted. This date was a turning point, after which all matters of health and preventive medicine came under military control of the 8th Military District, and of other army formations which replaced it. As a corollary the Australian New Guinea Administrative Unit, or as it became known, Angau, was formed: its functions were to carry out the civil administration of Papua, and to assist the commander in operating against the enemy by the use of the special knowledge and experience possessed by their members. More will be said in due course about this unit, and in particular its medical section. At this time the force in the 8th Military District in New Guinea included the 30th Brigade, made up of the 39th, 49th and 53rd Battalions; the 8th Military District was under command of Major-General B. M. Morris.

February brought fateful decisions in both Australia and the Far East. The fall of Singapore, with the consequent loss of the 8th Division, took place on 15th February, and after a period of uncertainty the I Australian Corps was eventually recalled to Australia. The need for adequate defence was significantly underlined by the damaging Japanese raid on Darwin on the 19th.

MEDICAL ARRANGEMENTS

There were important reasons why the defence of Papua should be backed up by an efficient medical service, since it could be seen that the Australian forces would be more widely separated than previously. Downes, now appointed as Inspector-General of Medical Services, visited Moresby in February with Lieut-Colonel J. B. Galbraith. Some expansions were then taking place. In March the base hospital was transferred to King's Hollow twenty-one miles up the Laloki River from the port, and became the 46th Camp Hospital. There was also a Red Cross convalescent home at Rouna, twenty-four miles from Moresby, and several miles farther up the river a site for the 113th Convalescent Depot was selected. The 3rd Field Ambulance had then moved its M.D.S. to Bomana Mission in the Twelve-mile Valley, and a new A.D.S. was being prepared a mile and a half from the Seven-mile aerodrome. The general health of the men was good; dysentery, previously a cause of considerable disability, was subsiding, but primary infections of malaria were now reported, showing obvious deficiencies in the preventive mechanism. Dengue was also occurring; post-febrile depression was not uncommon as a passing sequel.

During March Japanese bombers made thirteen fairly heavy daylight raids, one of which swept the valley where Murray Barracks was situated, rousing doubts as to the advisability of siting a medical unit there. Considerable damage was done but there were no casualties. A new site was found for one A.D.S. farther along the river at Rigo Road, known

as Eirama Creek, and another was moved to Frome Road: one of these had previously been stationed opposite a wireless transmitting station. The static nature of the defence of Moresby of itself tended to increase caution in the placing of medical units; so too did the limited air strength available, hitherto consisting of the Australian-manned Hudsons of the No. 32 Squadron. Welcome additions to the air forces were American bombers, and on 21st March four Australian Kittyhawk fighters of No. 75 Squadron arrived, though these latter were fired on at their first appearance owing to lack of recognition.

Enemy activity was evidenced early in March when the Japanese landed forces unopposed at Lae and Salamaua on the north coast. The only defence forces were two companies of the New Guinea Volunteer Rifles, whose existence was somewhat precarious, particularly in the matter of food, although dumps had been established. Their supply route was through Bulldog, along a difficult trail. The role of the force was one of active patrolling, with harassment of the enemy, hence when the Japanese came they withdrew into the steep hills behind Salamaua and the Markham Valley and demolished bridges and power houses. The maintenance of a small patrol force on the flank of the Moresby area was part of the deliberate strategy of defence, which included also the recognised possibility of operations in the Milne Bay area, and over the mountain trails through Kokoda from the north coast to Moresby. The expectation of further Japanese air activity over Moresby raised the question of moving the holding sections of the 3rd Field Ambulance to safer locations. The dysentery hospital was moved to Lux Lane above Rouna Falls, there to act as a hospital for infectious diseases. The M.D.S. was moved to a site seventeen miles along the river. Practically all the constructional work necessitated by these moves was carried out by members of the unit.

General MacArthur arrives in Australia

An outstanding event was the dramatic arrival of General Douglas MacArthur at Darwin on 17th March. About this time too the 32nd and 41st United States Divisions were beginning to land in Australia, and the I Australian Corps with the 6th and 7th Divisions A.I.F. were also arriving on the mainland from service in the Middle East. It was inspiriting to the 4,000 to 5,000 troops then in Moresby that the defence force was growing, for this force, spread thinly over the coastal areas near Moresby, was small by comparison with that now assembled by the Japanese in other parts of New Guinea.

In New Guinea encouraging signs of progress were seen. The sea strength of the Allies in the South-West Pacific was growing, and, more evident to the force, increasing numbers of American servicemen were landing in New Guinea. Their own medical installations were not yet ready, and some of their sick were cared for by the Australian services. A coloured engineer unit gave prompt and most useful service to medical units in need of help.

MEDICAL DEVELOPMENTS

Another valuable addition to the medical amenities of the Moresby area was the establishment of the 113th Convalescent Depot, commanded by Major J. H. Thorp. Before the end of March this unit had settled into a site in the Sogeri Valley, and had received 150 convalescents. During the course of the New Guinea campaign, this unit grew and extended so that by December 1943 over 3,500 convalescents were on the ration strength. The work of the 113th Convalescent Depot was not only directed towards the building up of convalescents: in the commander's words "while their physical welfare was of prime importance, it must also be stressed that their mental and spiritual welfare was also well catered for". In addition useful pioneering work in tropical hygiene was accomplished, and a high standard of personal and unit hygiene was set.

Perhaps staffs of medical units became sensitive to fluctuations of morale among those troops who came under their care; in the 3rd Field Ambulance a certain feeling of isolation among the men was detected; this was due no doubt to the lack of ability to supply the complete answer to the Japanese air attacks, and accentuated by an unwelcome period of six weeks during which no mail was received. Amends were made when great quantities of mail arrived in the middle of March, an event which vied in the eyes of the troops with the landing of the Kittyhawks.

During April the air attacks on Moresby slackened. Most of the raids were by Zero fighters; in one of these the Bomana M.D.S. was involved in an attack on the Bomana aerodrome, but no patients were hurt. The M.D.S. was sited between the fighter aerodrome and the water pumping station, and the unheralded attacks of fighters at low level were found to be rather more disturbing to patients than bomber raids of which longer notice was possible. The withholding of land-based bombers by the Japanese at this time was no doubt connected with their preparations for an assault on Moresby. Coming expansion of the Allied air forces was evidenced by the speed with which new airfields were laid down. The previous inadequate aerodromes in the Moresby area had grown into six first-class strips, but in the early days of small things the value of the contributions of the defence pioneers must not be forgotten, with their spirit undaunted by deficiencies in equipment or strength.

Commitments of the medical services were obviously growing too: Brennan was appointed A.D.M.S. of New Guinea Force on 15th April, with Foote as D.A.D.M.S. This new designation of the formation was involved in some confusion at this time.

On 17th April the 2/5th Independent Company arrived in Moresby; a decision was made to utilise this unit in a new force to be known as Kanga Force in the Wau-Salamaua area. The headquarters was to be raised from details in Moresby, and the force consisted of the New Guinea Volunteer Rifles, the 2/5th Independent Company, and a reinforcement platoon of the 2/1st Independent Company.

During this month the work of the field ambulance was increased greatly by the rising incidence of malaria and dengue, particularly among

the medical personnel, an experience afterwards repeated in other areas. As the wards were full this threw added strain on the staffs.

May opened with a feeling of anxiety about the expected enemy offensive, accentuated by a warning from the brigade Intelligence officers that a continuous air attack might early be expected, its objective being to keep the Allied planes on the ground. The Japanese had given evidence of activity in other zones; as we know they had made landings in Lae and Salamaua during March. Farther afield during April they made raids on Colombo and Trincomalee, though they were repulsed with heavy losses; these were less significant to the Moresby garrison than the successful enemy landings nearer home, on Bougainville and the Admiralties. Air reconnaissance revealed that the Japanese were concentrating two groups of vessels, carriers, cruisers and transports, but whether these were to be aimed at Moresby, or North Australia or both, there were no illusions about the present threat to Moresby.

CORAL SEA BATTLE AND AFTER

The high command, aided by decoded Japanese ciphers, decided that the enemy forces were aimed at Moresby, and possibly also against bases on the Cape York Peninsula on the Northern Queensland coast, and on 4th May began a remarkable sea-air action in which offensive thrusts were made by carrier planes. Heavy damage was inflicted on the Japanese forces, and between 4th and 9th May action ranged over hundreds of miles, mainly south of the Solomons, until the double prong of the invading fleets of carriers, cruisers and convoys was routed and thrust back.

The R.A.N. and R.A.A.F. played a significant part in this battle. Allied ships under Rear-Admiral J. G. Crace maintained an effective defence of Moresby and the islands south-east of New Guinea under heavy air attack, and Allied land-based bombers from Moresby located and attacked the Japanese western invasion force. As a result of this engagement Moresby remained firmly in Allied hands, a base invaluable in the defence of Australia and necessary for the prosecution of the coming land war against the invaders.

There was, of course, no under-estimation of the activity and aggression of the Japanese, for example in their submarine attacks on Allied merchant shipping, and their bold but abortive venture on the night of 31st May-1st June when midget submarines entered Sydney Harbour.

Since the Japanese held Lae, Salamaua and Finschhafen it was likely that they would attempt an inland drive from this part of the north-east coast of New Guinea, and an advance on Moresby over the mountain ranges was also possible. Welcome additions to the Allied land forces in New Guinea could be foreseen.

It is of interest to note that the 2/5th Independent Company, intended to be part of Kanga Force operating in the Wau-Salamaua sector, was held in Moresby until after the Coral Sea battle. Its function was the defence of Bootless Inlet, where it was suspected the Japanese might

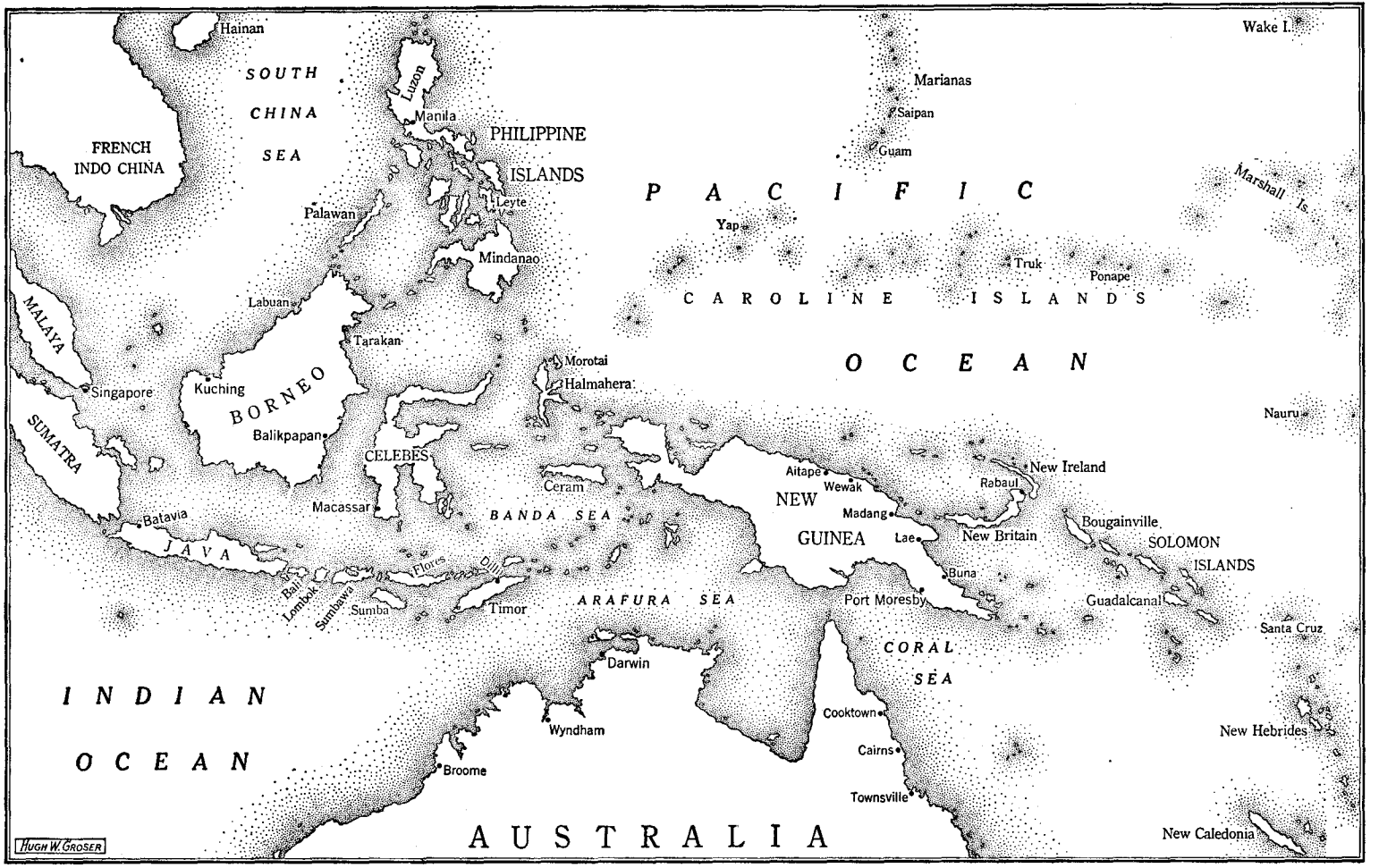
attempt a landing. After the sea-air battle was over most of Kanga Force including the 2/5th Independent Company, was flown to Wau. This was the first substantial movement of troops by air in New Guinea.

STRENGTHENING THE MEDICAL FORCES

A week after the Coral Sea battle reinforcements to the 30th Brigade in Moresby arrived, comprising the 14th Brigade, with the 3rd, 36th and 53rd Battalions, and the 14th Field Regiment. Additional medical services were also needed, both to care for the enlarged forces and to lift some of the burden from the 3rd Field Ambulance, a unit which had hitherto supplied medical cover for the whole of the defence force in the area, from aid posts to fixed hospitals. On 3rd June the 2/2nd Australian Hospital Ship *Wanganella* arrived in Port Moresby bringing the 5th Casualty Clearing Station and the 14th Field Ambulance. The 5th C.C.S., previously known as the 105th C.C.S., was the first medical unit to arrive in Moresby whose commander and senior officers had experience in the Second A.I.F. overseas. Lieut-Colonel T. G. Swinburne had been able to include Majors T. H. Ackland and R. R. Andrew as surgeon and physician respectively, and a "Q" staff transferred from the 2/6th Field Ambulance. From the first the value of experience was seen, as the unit needed all the advantages of a high priority at army headquarters and all the drive of its staff to have deficiencies of stores supplied, packed and shipped with the personnel of the unit in a few days. Soon after its arrival this unit set up near the Laloki River, seventeen miles from Moresby, and within a few days was starting a hospital.

The 14th Field Ambulance, under the command of Lieut-Colonel M. S. S. Earlam, had been acting in support of the 14th Infantry Brigade in New South Wales. Before embarkation plans had been made for members of the staff to receive special instruction in tropical medicine, but for lack of time they had to leave without this advantage. New Guinea Force decided that this unit would relieve the 3rd Field Ambulance of some of its responsibilities; officers and orderlies were detached for this purpose, which also enabled them to acquire first-hand knowledge of local medical conditions. The ambulance as a whole assumed the duty of servicing the 30th Infantry Brigade: the headquarters moved to the somewhat exposed site of the Bomana Mission, and there took over the care of some sixty patients, a number which rose to a maximum of 160 before the end of the year.

The 3rd Field Ambulance was assigned the task of supporting the 14th Brigade in the Bootless area. These arrangements were not made easier by an epidemic of measles, which broke out among late arrivals of the 14th Brigade. "A" Company of the 14th Ambulance set up a measles hospital in Murray Barracks to deal with the outbreak, which soon affected over 200 men. This unit, in addition to setting up action stations in the sites occupied in the Moresby area, also had the task of acting as an evacuation centre for patients being transferred to the mainland.



Islands of the Pacific

FURTHER PLANNING

Early in June the growing New Guinea Force was further encouraged by the news of another naval success; the American naval forces severely defeated Japanese naval and air forces threatening Midway Island. This came at an appropriate time, as during May a project had been conceived to provide more air facilities at Milne Bay.

Milne Bay. This strategically placed harbour at the southern tip of Papua had strong natural landward defences, and its possession was desirable as a stable land and air force base protecting the south-western flank of Moresby. During June the beginnings of a defence force at Milne Bay were made by the despatch of two Australian infantry companies and a machine-gun platoon to the area, with also a company of the 46th United States Engineer Regiment. These troops began to work on an air-strip at Waigani, west of the head of Milne Bay.

Wau-Salamaua. On the other flank there was increasing need to watch the movements of the Japanese round Lae and Salamaua, lest they should establish a connection with the high ground of Wau. Surveillance and harassment of the enemy were being carried out by Kanga Force, which, as we know, had been formed in May. The medical problems involved here were of interest. Before the expansion of this force, its organisation was self-contained, and only simple medical attention was required and carried out. More will be said of this aspect of the work, but it may be remarked here that the country over which these men ranged included cool climatic conditions at an elevation of 6,000 feet, and hot humid climate characteristic of lowland jungle and coastal areas. The malarial hazards were considerable in parts of this country.

Owen Stanley Range. June brought a great quickening of military preparation in those parts of New Guinea where there seemed likelihood of action. Months earlier Morris, following warnings from the Australian Army Headquarters, had watched for signs of Japanese activity on the north coast. After they had landed in Lae and Salamaua in March, because of their further interest in Buna and Gona the possibility of an enemy advance on Moresby over the formidable Owen Stanley Range was seriously entertained. Consequently, early in June Morris sent the Papuan Infantry Battalion, a small force of 300, to patrol from Kokoda on the foothills of the range to Awala where the hills flattened towards the coastal plain. Later the 39th Battalion and the P.I.B. were assigned the task of holding the "Kokoda Gap" against any Japanese forces attempting to cross the mountains.

Moresby. Meanwhile Moresby had its own problems. With a likelihood of a strong and determined enemy making a bid for Milne Bay, or infiltrating inland from Lae and Salamaua, or making a bold frontal advance on Moresby itself it was imperative that Moresby should be medically well equipped. Forward medical services would be required, and these would have to cope with all the hazards of tropical disease in a most difficult country. Base medical units would be needed in the

area, and all the arts of preventive medicine would be called upon to keep the base free of endemic disease and safe for considerable reinforcements. Of the various hazards the most dangerous were dysentery and malaria.

DEFECTS IN HYGIENE

When the 5th C.C.S. arrived Swinburne and his senior officers were soon aware that a firmer anti-malarial discipline was needed in Moresby, such as that applied during the later occupation period of Syria. Mosquitoes abounded, nets were inadequate and often inefficient; much more prophylactic work was badly needed, and there was reason for doubting if suppressive quinine was taken with any degree of regularity. Even in the headquarters of New Guinea Force there was obvious laxity, as judged by the incidence of malaria and the breeding of mosquitoes near the officers' mess. This state of affairs was due largely to insufficiency of officers who were experienced, young and physically fit. Swinburne discussed these matters with Brennan, who sent a signal to the D.G.M.S. asking for Colonel N. H. Fairley to come up and advise what should be done.

Fairley's Visit. On 26th June Colonel Fairley and Major I. M. Mackerras arrived to investigate the local position. They made a report to the D.G.M.S. shortly after their return to the headquarters in Melbourne. They pointed out that the Territory of Papua as a whole was a very wet area with a climate suitable for perennial mosquito breeding, and plenty of surface water; and a high endemic rate for malaria might be expected. Moresby, however, differed sharply from the rest of the island, having a well-marked dry season from May to January which should limit transmission of malaria during those months. Its rainfall was only about 30 inches a year, and a considerable degree of anopheline control had been previously achieved. Recently a disappointingly high rate of infection had existed not only among the natives but also among the troops.

The dispersal of troops along the Laloki River and for several miles on each side had increased the difficulties of control. Examination of children showed a splenic index of some 77 per cent in widely dispersed areas, and Major E. Ford found indices of 90-100 per cent in some of the islands near Samarai in the China Strait. The incidence of malaria in troops of New Guinea Force was disturbingly high, despite the adoption of the suppressive use of quinine. Up to June the force had a strength of 6,091 to 7,676 men, and in the first six months of 1942 1,184 cases of clinical malaria were treated. This gave a clinical infection rate of 149 per 1,000 for that period and if latent malaria was included the total infection rate was about 45 per cent. Test surveys confirmed these figures. The personnel of the 3rd Field Ambulance showed a figure of 34 per cent infection proven by films. Fairley and Mackerras considered that 50 per cent of all those in the Territory for six months were infected. Brennan had found that during 1940-41 benign tertian predominated, but malignant tertian appeared in February 1942. In June, 88 per cent of the malaria

seen at the 5th C.C.S. was M.T., and 73 per cent at the 3rd Field Ambulance. Diagnostic facilities, which earlier had been limited, were at this time satisfactory, since microscopes and stains had been distributed to the necessary centres. This had been made possible by the arrival of new medical units with the materials required. A mobile laboratory would have simplified this work considerably, but arrangements were made for the training of officers and technicians in diagnostic methods using thick films. The work of a staff sergeant technician in the 14th Field Ambulance was of great value.

There was no general hospital in the Moresby area and patients with malaria were held and treated in all medical units. The standard of treatment was not uniform and was incomplete, as plasmoquine was not available. This was important, because without the use of this drug as a gametocide carriers were created, and under existing conditions mosquitoes were readily infected, thus perpetuating the cycle. The most important anophelines found in the area were the *A. punctulatus typicus* and *var. moluccensis,* the latter being known as the significant vector. The commonest breeding grounds were clear pools, seepages from swamps and backwaters of streams; these mosquitoes were also known to breed in clear or muddy water in traffic marks, in tins and brackish pools. The problem of control was recognised as considerable. Therefore the report stressed the importance of control by all available methods, and pointed out that the position to date was unsatisfactory. Not only were the troops running risks as their forces spread out into uncontrolled areas, but were adopting a fatalistic attitude to personal protection. Fairley and Mackerras noted that difficulties in distribution and supervision of quinine contributed to poor results, but in view of the dry season (August to December) suggested that groups of men should be taken off quinine and watched for relapses. The saving of quinine thus gained would be welcome.

The departure of natives from the area since the bombing raids began had removed the natural reservoir of malaria, but unfortunately another reservoir had been established, the highly dangerous one of the troops themselves. It was therefore imperative that the carriers should be reduced in numbers by treatment, and a campaign against anophelines should be begun and intensified during the wet season, after which lavish breeding might be expected. Little destruction of adult mosquitoes was being attempted, though buildings were occupied in which they could be attacked, and sprays and nets were an urgent necessity. Protective clothing was not being worn, nor were repellents used. No educational schemes were being followed, and in fact the anti-malarial discipline of New Guinea Force at this time was poor.

Fairley and Mackerras submitted plans for the carrying out of the urgently needed measures, beginning on the mainland with adequate training and following on in New Guinea with all recognised means of prophylaxis. They concluded by warning that malaria was capable of destroying the effective force and could thus decide the issue of the campaign in the South-West Pacific.

Dysentery. The other disease of importance to the force was dysentery, of itself not severe, but, when widespread, a cause of serious wastage. As we have seen, part of the 3rd Field Ambulance laboured to provide hospital attention for men with this and other infectious diseases, though greatly handicapped by lack of staff and equipment. Even in June 1942 beds were rudimentary, without mattresses or nets, and flies could not be properly controlled. The 5th C.C.S. was able to help other units by expanding its scope; in particular by admitting men with dysenteric diseases, who otherwise would be held in a dressing station. Special fly-proof wards were constructed and the methods followed which had been laid down in the Middle East and there proved effective.

Some of the criticism of the medical conditions prevailing in Moresby at this time by medical officers and units entering the area was hardly fair, for it was not always realised what difficulties had to be surmounted in an area that was for a time a kind of military backwater. Moreover a number of those who had borne the load of pioneering in the early days, though experienced and competent, had not always the advantage of that type of technical and administrative experience demanded in the area, nor the greater advantage of youth. It must be remembered, too, that Moresby was subjected to frequent air raids, both by day and night, and up to the middle of 1942 retaliative action was not very effective. Other factors of importance which reduced the effectiveness of medical units were meagreness of transport and the very bad condition of most of the roads. But in spite of such difficulties, arrangements were made to cope with the medical needs of every day, and also military emergencies which would have arisen had there been an enemy attack. A surgical centre was kept prepared in the Murray Barracks, ready for use by the 5th C.C.S., and the 3rd Field Ambulance had set up a theatre at Eirama Creek, in case the threat to Moresby should become a reality.

CHANGES IN COMMANDS

General Sir Thomas Blamey recommended on 25th July that Major-General Morris should command the line of communication area and that Major-General C. A. Clowes command the field forces. On 1st August Clowes was listed as commander of New Guinea Force and Morris as commanding the New Guinea line of communication area. This was complicated by the arrival simultaneously with Clowes of Lieut-General S. F. Rowell, commander of I Australian Corps, and some of his staff. Rowell then became commander of New Guinea Force and I Australian Corps from 12th August, the date of his arrival. Two days later Clowes went to Milne Bay in command of Milne Force. With him went some staff officers previously attached to New Guinea Force, including Colonel G. B. G. Maitland, who thus became A.D.M.S. of Milne Force.

These arrangements held good until the end of 1942. Lieut-General E. F. Herring followed Rowell as General Officer Commanding I Australian Corps and New Guinea Force on 1st October.

CHAPTER 2

OWEN STANLEY CAMPAIGN KOKODA TO IMITA

LATE in June Major-General Morris, commander of New Guinea Force, assigned to the Papuan Infantry Battalion and the 39th Australian Infantry Battalion the task of preventing any movement of the Japanese across the Owen Stanley Range through the Kokoda Gap. The Japanese had not yet landed in Papua, but for months their aircraft had been regularly bombing Port Moresby. Early in July General MacArthur ordered the assembly of a force of some 3,200 men to construct and defend an airfield in the Buna area. It was to begin operations early the following month.

Kokoda was easily accessible from the north coast of Papua by tracks which led gradually up to an elevation of a mere 1,500 feet, where there was a most useful airstrip. From the Moresby end, however, the line of communication by land route ran over the arduous Kokoda Trail, rising and falling steeply and incessantly over a range whose highest peak rose to 13,000 feet, and to cross which a climb of 7,000 feet was necessary.

THE KOKODA TRAIL

This trail was in reality a native road, no doubt of ancient origin, and followed the primitive idea of dropping into deep valleys only to clamber up forbidding heights, instead of the more modern notions of surveying in terms of levels. Even the road from Moresby to Koitaki, some twenty-five miles from the port, was not really practicable for motor traffic until engineers blasted a wider path, and the journey from the upper reaches of the Laloki River to Ilolo, always difficult, became impossible after heavy rain. In the early stages of the campaign only jeeps could venture past Owers' Corner in wet weather, but later, heavier vehicles could make this trip of seven miles along the Imita Ridge. At this point the track rose to over 2,000 feet, and then dropped steeply into the valley down the four miles of the "golden stairs".

In following the vicissitudes of the troops engaged in this remarkable campaign we shall see how the rigours of this formidable trail had a constant bearing on the medical aspects of the fighting. The work at each post, dressing station or resting place was done under difficulties intensified by relentless nature, though even to tired men the scene was often beautiful and always impressive. Colonel F. Kingsley Norris has embodied in a report on the medical services a description which has become so well known that it is part of the history of the action:

> There was but one axis of withdrawal—a mountain track which defies adequate description. Before the campaign, this route had been considered passable only to native or trained district officers. Imagine an area of approximately 100 miles long —crumple and fold this into a series of ridges, each rising higher and higher until 7,000 feet is reached, then declining in ridges to 3,000 feet—cover this thickly with jungle, short trees and tall trees tangled with great entwining savage vines—

through the oppression of this density cut a little native track two to three feet wide, up the ridges, over the spurs, around gorges and down across swiftly flowing happy mountain streams. Where the track clambers up the mountain sides, cut steps —big steps, little steps, steep steps—or clear the soil from the tree roots. Every few miles bring the track through a small patch of sunlit kunai grass, or an old deserted native garden, and every seven or ten miles build a group of dilapidated grass huts—as staging shelters—generally set in a foul offensive clearing. Every now and then leave beside the track dumps of discarded putrefying food, occasional dead bodies, and human foulings. In the morning flicker the sunlight through the tall trees, flutter green and blue and purple and white butterflies lazily through the air, and hide birds of deep throated song or harsh cockatoos in the foliage. About midday and through the night, pour water over the forest, so that the steps become broken and a continual yellow stream flows downwards, and the few level areas become pools and puddles of putrid black mud. In the high ridges about Myola, drip this water day and night over the track through a foetid forest grotesque with moss and glowing phosphorescent fungi.

Through this mountainous country the track wound, in places opening into more or less extensive clearings or areas that would accommodate a body of troops, in others narrowly clinging to a cliff's edge or passing along or through fast running streams. The trail led through Ilolo, over Imita Ridge and Ioribaiwa, through Menari, to Efogi, with its tiring last steep scramble to the village, past Kagi, where the giant shadows of 13,000-foot Mount Victoria fell on the lower peaks of the range, past Myola, with large flat areas of great use to the medical services but not as dry as they looked, and so up to Templeton's Crossing, its highest point rising to 7,500 feet. Then came the precipitate drop to Eora Creek, and so on through Alola, Isurava and Deniki to Kokoda. Kokoda was on a plateau where a grove of rubber trees led from the approaches to the range, and on the other side merged into the station gardens with its deserted house.

Late in June the patrol force of the Papuan Infantry Battalion was well on the coastal side of the range, in the Awala area; as yet the 39th Battalion had not left Moresby and still had before it the task of traversing the trail from Ilolo over the southern side of the range to Kokoda. It was evident that there were difficult and urgent problems of supply to be solved. At this stage little or no help could be looked for from aircraft, for transport planes were scarce, and there were none based on Moresby. The Territories of New Guinea and Papua had produced, before the war, a remarkably air-minded class of white inhabitants, but military transport in the island was not so advanced. The importance of Kokoda in the coming land struggle for Moresby was obvious.

Sea transport to and from the plains below Kokoda was possible only if the necessary bases could be established and held; already it was evident that this was not practicable. An instruction was issued on 15th July to "Maroubra Force", as the composite body north of Kokoda was called, to take and hold Buna, but this was promptly withdrawn. The only practical alternative was to employ native carrier lines over the mountains from Moresby, and Angau had already, during June, undertaken the necessary organisation. On 7th July the first elements of the 39th



New Guinea—General

Battalion began the journey from Moresby to Kokoda. They had no medical officer at this time, but Sergeant J. D. Wilkinson was attached as regimental medical N.C.O. The position in Moresby was difficult with regard to medical assistance. The A.D.M.S., Lieut-Colonel Brennan, was ill, and working under difficulties; medical officers were in increasing demand and the militia troops in Moresby had not had the benefit of thorough training under experienced leaders. The ground forces in Moresby included 1,098 A.I.F., 12,273 militia, and 2,208 Americans. The 39th Battalion was rated as the best of the militia troops.

The organisation and experience of Angau in the work with native bearers was invaluable from the beginning, but the outstanding work and influence of Captain G. H. Vernon demand special mention. Vernon had outrun by age his term as a government medical officer, and left a rubber plantation near Kokoda to offer his services to the army, and was able to rejoin the forces to work with Angau in spite of being obviously much over-age. In a native hospital at Sapphire Creek he found that many of the native carriers then being used along the Owen Stanley track were sick and in poor physical condition. He was sent to Ilolo and there set up a medical base and hospital for carriers and with the help of Sergeant H. P. Ferguson supervised the provision of safe sanitation. His sphere of work was extended to the whole line to Kokoda, and this gaunt old man ranged up and down the track with an activity that disarmed men half his age. He understood the natives, regulated their loads, which were standardised at 40 pounds (previously 50 pounds or more), secured them adequate rest and rations, refused to let them work if truly unable, though he often reluctantly sent tired men out on essential tasks, and looked after them when sick. He understood the reluctance of native medical orderlies to leave base areas for work on ranges, but would not allow them to escape service by subterfuge, and raised their corporate spirit to a higher level. Vernon had a correct appreciation of the physique of many of the native workers, especially orderlies, who had softened in easy work at the base, but later these men became adept at hill climbing. He admitted in his diary that the first of the Owen Stanley hills was a great deal worse than he had expected, but he surprised experienced Angau warrant officers in his ability to withstand the incessant ups and downs of the rough slippery trail.

THE JAPANESE ATTACK

While Vernon was making his reconnaissance of the trail with his native carriers an important event occurred which radically changed the position. On the evening of 21st July the Japanese attacked Buna and Gona from the sea; they shelled Gona and bombed Buna, and made successful landings through the night and on the following day. They lost little time in moving on, and were sighted by a patrol at Sangara on the evening of the 22nd. Next day the first part of the 39th Battalion, which had advanced as far as Awala, was involved in a clash with the advance elements of the Japanese force. Additional medical aid was imperative.

At the Moresby end the remainder of the 39th Battalion was now ordered to move to Kokoda. The R.M.O., Captain J. A. M. Shera, accompanied "C" Company on 23rd July, and the next day Captain W. W. McLaren and five O.Rs. detached from the 14th Field Ambulance, were sent from Moresby to establish a dressing station in the Kagi area on the Owen Stanley Range. Each member of his party took a load of 47 pounds, 17 pounds of which was carried by natives, who also transported medical and surgical equipment and stores, and ordnance stores. A further party from the battalion left Moresby on the 25th. The remainder was to move by air to Kokoda, beginning on the following day, but only two plane loads could be landed by the sole available transport plane.

On the 25th Brennan was forced to relinquish the position of A.D.M.S. of New Guinea Force through illness, and returned to the mainland. Lieut-Colonel N. S. Gunning was appointed Acting A.D.M.S. in his stead.

At the other end of the long tortuous line of communications the 39th Battalion was now being withdrawn to Kokoda. Vernon reached Deniki on the 27th through the rough gorges from Eora, and reported to the commander of the 39th Battalion. As medical officer to the carriers he had come forward to give them medical care, and he placed himself at the disposal of the troops if he was needed. The battalion was still without a medical officer as the R.M.O. had not yet arrived, and Vernon, on being told to stand by for orders, lost no time in joining Wilkinson and one of the Angau medical assistants, Warrant Officer D. S. Barnes, who had joined this part of the force after retirement from Awala was ordered. He found them busy attending to many men with painful and damaged feet, and others with malaria, no doubt relapsing attacks. Some were seriously ill from the combined effects of malaria and exposure to the cold and wet of the higher levels. Next morning after a cheerless night in the cold windy extemporised hospital, Vernon was ordered to join the main body of the battalion with Barnes at Kokoda.

The opposing forces facing each other in the Kokoda area had terrain of a very different kind behind them. The Japanese were pressing forward from their recently acquired bases at Gona and Buna with but a short distance for their troops to cover over gradually rising slopes leading to the heavy toil of the mountain trail. The incomplete and meagre 39th Battalion had behind them the incredible line of communication of this trail, which was, unless they could deny the Kokoda airstrip to the enemy, their sole link with Moresby. Over this trail had passed some of the defenders, and Vernon with his band of native carriers from Ilolo on the southward slopes. Over it was approaching the remainder of the 39th Battalion with the R.M.O. and McLaren's medical party, which caught up with the battalion at the fertile valley of Nauro.

ACTION AT KOKODA

The last air trip to Kokoda brought in another platoon from Moresby on the 26th, but "A" and "C" Companies of the 39th Battalion had not yet arrived. Next day walking wounded were sent back from the Kokoda

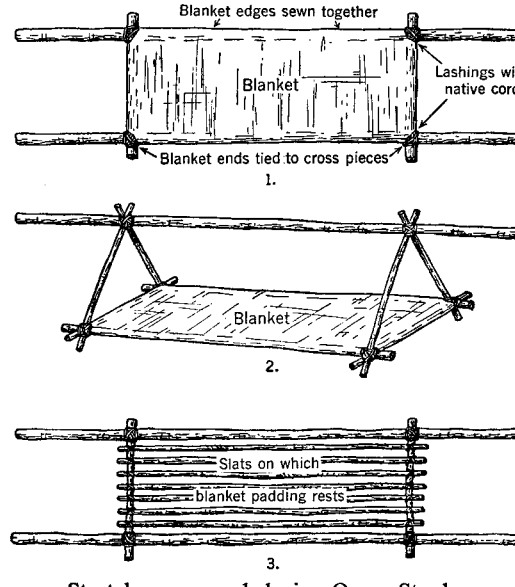
area, and as Oivi was found untenable the battalion began to withdraw. An R.A.P. was set up in the police house at Kokoda, and was prepared for casualties. Early on a cold evening with the light of a full moon shining through the mist on the heavily shadowed rubber trees, the Japanese attacked. The first casualty was the commander, Lieut-Colonel W. T. Owen. Vernon moved him to the R.A.P., but he was mortally wounded by gunshot fire. There were only a few other casualties and these were not serious, and after their wounds had been dressed they retired to Deniki with the troops. Major W. T. Watson, commanding the Papuan Infantry Battalion, was now in charge; he and Vernon were the last to leave, and ensured that no one needing help was left behind before they made their way out through the gathering mist. By dawn they were in the foothills, and the wounded were tended, including some who had not gone through the aid post. Retreat was inevitable with some ninety men facing a force much superior in numbers, and most of the medical equipment except the instruments had perforce to be left behind. So Kokoda was left in its misty silence, with the high peaks of the ranges and the stream-cleft valleys between the little Australian force and its base.

Early on the 29th all but the rearguard reached Deniki in drizzling rain where the wounded were seen and further treated. McLaren's field ambulance party had meanwhile caught up with "C" Company of the battalion, and learned that "B" Company had clashed with Japanese patrols at Awala. Pressing on to Eora Creek they learnt the disquieting news of the loss of their commander, and of the forced retreat of "B" Company after heavy fighting. Next day McLaren's detachment arrived at Eora Creek and on the advice of Watson set up an aid post there. The Eora Creek post was in Vernon's opinion badly sited, as it was too far from Kagi for the carriers and would have been better to be nearer Templeton's Crossing on level ground. The camp "was a little side knoll, high above the streaming white creek below—a dreary windswept sunless perch with great mountain walls towering on each side". Shortly afterwards the first casualties arrived and were treated in native huts made available by Angau. "A" Company of the battalion arrived there the same day, and the next day further casualties were brought in on stretchers by native carriers. Their wounds had been dressed by Vernon and Wilkinson at Kokoda or Deniki before they left; they were now redressed with sulphanilamide, and dosage by mouth was administered.

Shera came forward on the 30th with the first reinforcements to the battalion, and relieved Vernon, who returned over the trail to Isurava. Here he met McLaren, who asked him to look after the wounded at Eora Creek until further relief arrived. At Isurava, about 4,500 feet above sea level, as at other relatively high elevations, the climate presented a contrast to the humid heat of the coastal areas. Not only the sick and wounded needed protection from the cold, especially on damp misty nights; the soldiers and carriers also suffered considerable discomfort, often much accentuated by exhaustion. The rest hut was clammy in the misty air; its best part was described as the kitchen, with its fire and its cheerful cooks,

including one volunteer with a badly inflamed leg. Vernon returned to Eora Creek and there looked after all the sick with the help of an inexperienced orderly.

Most of the gunshot wounds were caused by the small calibre Japanese bullets which produced less injury and pain than those caused by other weapons. At this time and place it was fortunate that more difficult problems did not arise. It was found better not to interfere with wound dressings except for good reason. Even the wounded themselves did not always understand that care for their bodily needs was more important than re-dressing a wound which had been dressed a few hours earlier, though most of them were stoical of discomfort. On such terrain it was obvious that the walking sick and wounded needed fortitude, and the medical officers had to exercise firmness and discrimination. It was in the interests of some of the men to keep them at Eora Creek to allow them to improve before they faced the journey to Moresby. Indigestion was a common complaint; bicarbonate of soda gave relief but the supply was scanty.



Stretchers as used during Owen Stanley campaign

The condition of the native carriers caused some concern; for two weeks they had had only rice to eat, though they carried tinned meat for the troops, and they suffered from cold at night owing to the shortage of blankets. Vernon strove to save the carriers from being overloaded, and from undue discrimination in their treatment, and conserved his labour force as best he could. At least eight bearers were needed for each stretcher case; no less number could carry a sick or wounded man over the track in safety or comfort. The hardest work allotted to the natives was that of carrying wounded on stretchers. The start of the homeward trail from Eora was particularly difficult, it led up one of the steepest and roughest hills on the whole track: physical effort was needed to keep foothold on the stones and roots on its almost vertical slopes; for the barefoot stretcher bearers it was a severe trial. Keeping wounded men at Eora a few days sometimes enabled them to walk, thus saving unnecessary strain on the bearers. Norris has described the work of the native carriers as follows:

With improvised stretchers—one or two blankets lashed with native string to two long poles spread by stout traverse bars—as many as eight or ten native bearers would carry day after day. To watch them descend steep slippery spurs into a mountain stream, along the bed and up the steep ascent, was an object lesson in stretcher bearing. They carry stretchers over seemingly impassable barriers, with the patient reasonably comfortable. The care which they show to the patient is magnificent. Every need which they can fulfil is tended. If night finds the stretcher still on the track, they will find a level spot and build a shelter over the patient. They will make him as comfortable as possible, fetch him water and feed him if food is available—regardless of their own needs. They sleep four each side of the stretcher and if the patient moves or requires any attention during the night, this is given instantly.

The problem of dialects was difficult among these boys; bearers were sometimes assembled in groups who could not talk to each other. The Angau representatives were very helpful here and were able to group together the boys with a common tongue.

RETREAT FROM KOKODA

During the last two days of July the remainder of the 39th Battalion arrived at Eora Creek from Moresby. Here also casualties from the forward areas had collected, most of them suffering from exposure. The forward troops were still in contact with the Japanese, but only with patrols. At this time rations were scarce, and in order to avoid difficulties all sick and wounded who were able to proceed on foot were sent back along the trail, while stretcher cases were brought up by carriers and held for the time being. It was obvious that the slender Australian forces would need substantial strengthening in all ways and this would probably depend in the main on the use of one land route over which would come reinforcements, food, ordnance, and medical supplies. Medical care would certainly create an increasing problem likely to extend the capacity and ingenuity of the services concerned.

On 1st August the detachment of the 14th Field Ambulance took its equipment up to Isurava and there set up a post in a native rest hut. Sick and wounded men continued to come in over the next few days, but those unable to walk had to be held at Isurava owing to the limited numbers of native carriers. Therefore the possibilities of Deniki as a medical centre were considered, and McLaren was prepared to move his party on if the force took Kokoda. On the 7th the detachment buried excess equipment, and leaving an orderly at Isurava, went on to Deniki. Little was gained by this movement, as the situation in the forward areas was still fluid, and pressure from the Japanese made it necessary for McLaren to return to Isurava two days later. His party brought several patients on stretchers and asked by signal that further medical help should be sent up from the base.

Meanwhile the A.D.M.S. of New Guinea Force had strengthened the resources of the medical parties at the Moresby end of the track, and sent another detachment to Ilolo under Lieutenant W. R. Adam, comprising A.A.M.C. orderlies and motor transport, so as to have a post established

there accessible to Moresby. In accordance with McLaren's request Captain D. R. Wallman and nine other ranks of the 14th Field Ambulance left Ilolo equipped to deal with surgical work.

Before this detachment arrived to help fill the gap in medical and surgical aid between the roadhead at Ilolo and the forward areas, casualties began to increase in numbers, as the result of attacks and counter-attacks at Kokoda. Diarrhoea had begun to be troublesome among the men too, and by the 12th was so prevalent that preliminary arrangements were made to establish a diarrhoea hospital at Alola village forty minutes farther back from Isurava. Heavy fighting was now taking place at Deniki, and on the 13th the 39th Battalion withdrew from the Deniki area to positions at Isurava, over some of the steep declivities leading to the higher elevations of the range. Unfortunately the battalion lost all its medical equipment during this movement, and arrived at Isurava short of rations and with no supplies of blankets or clothing. The medical detachment took its patients and equipment back to Alola, and next day withdrew its main medical post to Eora Creek. Shera was ill but took over the work of the field ambulance detachment temporarily, while McLaren relieved him of the battalion duties. A staging post was also set up in charge of two orderlies at Templeton's Crossing. The pressure of the Japanese was lessening after their strong attacks, and on the 16th a brief period of relative respite began.

On that day the dispositions were as follows: Headquarters 30th Brigade (Brigadier S. H. Porter) at Alola, 39th Battalion (Lieut-Colonel R. Honner) near Isurava, and two companies of the 53rd Battalion, which had just arrived from Moresby, with a detachment of the P.I.B. also at Alola. Patrols were out along the two alternative tracks forward of Alola, both of which were likely to be used by the enemy moving from Kokoda and the Kokoda-Oivi track.

ARRIVAL OF 7TH DIVISION TROOPS

The most important event at this time was the arrival of the 7th Division A.I.F. Mid-August found the headquarters of this experienced division in Moresby, and on 12th August the Headquarters of the I Australian Corps arrived with Lieut-General S. F. Rowell in command. The medical services welcomed the help of the seasoned 2/6th and later the 2/4th Field Ambulances, though both units when they arrived were 20 per cent under strength. The increase in trained medical staff made possible the establishment of a series of relay posts down the track at Deniki, Alola, Eora Creek, Kagi, Efogi, Nauro and Uberi. Plans were made for casualties to be treated and held in these posts, and evacuation would be by native carriers, using native stretchers to the lower levels beyond Imita Ridge to a point where patients could be transferred to hospitals in the Moresby area by motor transport.

On the 19th and 20th a detachment of the 2/6th Field Ambulance, comprising two officers and thirty-one O.Rs., went forward under command of Major J. R. Magarey, senior medical officer of the forces in

the forward areas. A party of twelve O.Rs. of the 2/6th Ambulance supervised native bearer squads in the transport of patients from the R.A.P. to the advanced dressing station at Isurava, and the rear dressing station of the 14th Ambulance at Eora Creek where Wallman and his party had set up a main post and were able to take patients from the advanced post at Isurava.

The force now came under command of the 7th Division, and on the 23rd two battalions of the 21st Brigade, the 2/14th and 2/16th, were coming along the track. Supplies presented an even greater problem with the increasing numbers of troops: even the 600 native bearers who were working on the ranges could not supply all needs. The most useful adjunct to ground porterage was dropping supplies from the air, a manoeuvre demanding skill in packing, in choosing accessible spots for dropping, and in retrieving. Wastage was inevitable, but by using a "dry" lake at Myola near Kagi the "biscuit-bombers" could drop supplies with a reasonable percentage of successful recovery, and a fair reserve of supplies was thus collected. Unfortunately Japanese raids during the third week of August caught the transport planes on the Seven-mile airfield at Moresby, inflicting a loss which was perhaps the most serious of the many air raids in Moresby over the previous six months of frequent attacks. More aircraft were at length obtained, but the position was still insecure. The 39th Battalion was withdrawn to rest, but the 53rd was still in position; the 2/14th Battalion relieved the 39th, and was accompanied at Myola by the 2/16th.

Brigadier A. W. Potts of the 21st Brigade took over the command, on 22nd August. The existing posts at Isurava, Eora Creek and Templeton's Crossing were stabilised, and McLaren resumed control of the 14th Ambulance detachment.

WITHDRAWAL OVER THE RANGES

Other posts were rapidly being opened along the track with the additional personnel and equipment now available. Magarey had orderlies sent to Uberi, Ioribaiwa, Nauro, Menari and Efogi and reached Myola himself on the 22nd. At Myola he left Captain J. M. Oldham and orderlies and went to Templeton's Crossing, where a staging post was established. The scope of medical attention along the trail was thus considerably extended, and the post at Templeton's Crossing was meant to be used as a convalescent camp. Here, as at Myola, walking casualties were to be kept only until they were able to return to the base areas. The condition of most of these men was satisfactory, and thanks to care and the use of sulphanilamide, wounds were clean. Additional hospital facilities were now available for men reaching the Moresby area after the establishment and rapid expansion of the 2/9th A.G.H.

The brigade commander decided on the 24th that anti-malarial precautions be discontinued until further notice. This notice could have been given when the troops were north of Deniki, for at the higher elevations of the range there was no need to trouble about mosquitoes. The need

for greater attention to hygiene was stressed, and track discipline was imposed to include control of all persons passing along the trail and to prevent movement by unauthorised persons. A supply of ascorbic acid and salt tablets was laid down as being necessary with rations. Deficiencies of medical equipment were listed with the object of obtaining these from Moresby.

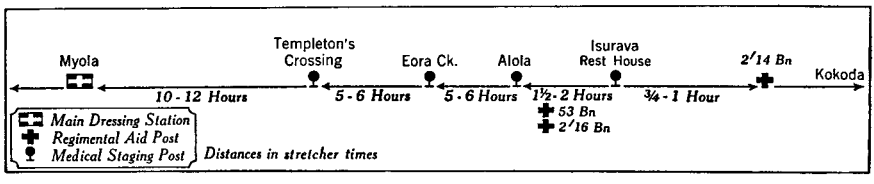
A medical plan was adopted to fit into the general tactical plan, by which the capture of Kokoda was envisaged, together with the cutting of Japanese communications between Kokoda and Oivi. Medical evacuation to suit these tactics was therefore planned on the unusual method of sending patients forward instead of rearward, so that they might be transported to base by air from Kokoda. The 2/14th and 2/16th Battalion casualties would thus be taken by regimental stretcher bearers to the forward posts, and thence by native carriers from the R.A.Ps. It will be seen that this plan could be fully implemented only if Kokoda was captured from the Japanese.

The period of remission of hard fighting on the mountains did not last long. On the 25th and 26th the rest house at Isurava was subjected to mortar fire, and the staff of this forward medical post was compelled to withdraw to Eora Creek, taking all equipment and casualties, including twenty-two stretcher cases. The 2/14th Battalion now withdrew to Isurava from more forward areas, and met intensified enemy attack from the 27th to 29th resulting in sharp losses. The 53rd Battalion began an advance towards Missima, but met heavy resistance and retired to Eora Creek. In this action the commanding officer Lieut-Colonel K. H. Ward was killed. Wallman's detachment found ample use for the surgical instruments and equipment they had brought from Moresby, and set up a surgical unit at Eora Creek. During the period from 4th to 29th August when McLaren's detachment had treated sick and wounded at Isurava, no casualties had been evacuated, but now some adequate method of disposal was imperative, though the difficulties were immense. Small groups of soldiers were passing at intervals up and down the track, native porters still carried stores, bearer squads still performed their arduous tasks, and walking sick and wounded made the best of their way back to the rearward posts. But this, the only practicable system of medical evacuation, could not be augmented except on a small scale. There was now a medical post of the 2/6th Field Ambulance at Myola, with Oldham and twenty-four men, and the same unit had staging posts at all the regular stops along the way.

The medical officers of the 2/14th and 2/16th Battalions, Captains D. G. Duffy and H. D. Steward, arrived and conferred with Captains Shera and A. B. Hogan of the 39th and 53rd Battalions: there was also discussion with the battalion and company commanders. The Japanese machine-gunned Alola village across the valley on the 27th: there were no casualties and the R.A.P. of the 2/16th Battalion at Alola was not moved. The aid posts of the 2/16th and 53rd Battalions were within fifty yards of one another, and were able to give mutual help in staging

casualties from Isurava. It would have been easier to move the surgical team forward from Eora Creek to the rest house, as this would save long carries, but movement would probably have invited further mortar fire. Duffy moved his aid post to take over from the 39th Battalion and was caring for many casualties.

The position is shown in the accompanying diagram.



Stretcher Times

On the 29th one man was killed and five wounded in a machine-gun attack on an area including the 53rd and 2/16th aid posts. Hogan, medical officer of the 53rd Battalion, was among the wounded.

Shortly afterwards, the brigade commander decided to withdraw, as the 2/14th Battalion was being outflanked and the brigade headquarters was coming under fire. There were then twelve lying patients at Alola, but by calling on all available carriers these were moved back from Alola. It was a very slow movement: there were not enough native porters, and Steward with his orderlies and others helped to carry stretchers. A message had been sent to Eora Creek to send forward all unladen carriers, but none were found in the gathering darkness. A suggestion was made to bring back carriers with lamps along the track, but the Angau officers advised against this, lest the natives so used be found missing in the morning. The brigade commander agreed by telephone that the native carriers be brought up at dawn. Warrant Officer F. A. Lord of Angau managed to find more natives and the movement of the stretcher cases began again towards Eora Creek. The superiority of the natives in this work was well in evidence: the white carriers could manage on a level track, but over the many steep and difficult places the patients had more discomfort, and the bearers became exhausted.

The mountainous jungle country in the region of Eora Creek imposed trials which were made worse by the conditions of living. Most of the infantrymen had only an anti-gas cape as poor protection from the tropical rain, which began regularly in the afternoon and continued through the night. The nights were very cold on the mountains, and it was impossible to supply warm food, owing to the closeness of the enemy. All drinking water was chlorinated in the bottles and was distasteful. The troops had to carry food and ammunition to the higher levels; these tasks occupied the day and sometimes part of the night. Food was scanty: one tin of bully beef was divided among seven men. Milk powder was found useful in feeding the wounded, who appreciated even a thin paste stirred with

the chlorinated water. The mental strain was even worse than physical fatigue. They could see little more than a few yards on either side through the dense jungle, and the risk of ambush was ever present.

Wallman and his detachment from the 14th Field Ambulance withdrew from Eora Creek to Templeton's Crossing with all their surgical equipment and supplies. All walking sick and wounded accompanied the party, and twenty patients were transported on stretchers. McLaren with three orderlies and twenty-three stretcher patients, walking wounded and such supplies as could be carried, withdrew to Eora Creek.

As the village at Eora Creek was in an exposed position it was desirable to move the stretcher patients some distance up the hill above the stream. There were not enough carriers available for this work, but after a personal appeal several men managed to walk with assistance, and at last reached the brigade headquarters, where they could be kept under cover till the morning. With the help of members of the Papuan Infantry Battalion and some carriers, all the patients were moved before dark to a high grassy area where they could be more or less protected against the cold and misty rain. Two patients had abdominal wounds, and one a sucking wound of the chest. Since they had no apparent chance of survival and no surgical measures were possible, Magarey advised a large intravenous dose of morphine, the action of which illustrated the extreme tolerance of persons with such injuries, but insured at least comfort in their last hours. Though abdominal injuries have always a high mortality, it is one of the tragic frustrations of medical services at war that some men who might have a possible chance of survival are doomed under conditions such as prevailed on the Kokoda Trail. After dark, several patients were found on stretchers some distance up the hill: the native carriers could not be found, but members of the P.I.B. brought them up safely by the light of a signals torch.

The only surgery permissible was the performance of purely life-saving measures, and Wallman's party with their equipment was sent straight on to Templeton's Crossing, where stretchers for the remainder of the journey to Myola would be brought by the supply line. McLaren's party was still at Eora Creek.

Up to this time no stretcher patients in McLaren's party had been sent back beyond Eora Creek, but it was now necessary to send them to Myola. It was hoped that aircraft could land on the "dry" lake at Myola, and take patients to Moresby, for the local position with native bearers did not then encourage the belief that a carrier force could be maintained of sufficient size to take lying casualties back to Ilolo. However, the immediate concern was to get patients back safely to Myola. This would occupy several days, during which the native carriers would not be available for transport of supplies. The only solution of this dilemma was to employ them on both outward and inward journeys, taking patients in one direction and supplies in the other. This endangered the stamina of the Papuan boys, and Angau officials were averse to it, but no other alternative could be seen.

By the 30th the whole medical detachment from the 14th Field Ambulance had arrived at Templeton's Crossing, where all sick and wounded and natives were fed, stretchers were repaired and adjusted, and dry blankets provided where possible. In view of the long carry ahead to Myola, some ten to twelve hours, rations for three meals were provided, and Lord, using carriers on hand and others as they arrived from Myola, contrived to have the whole party moving along the track in time for their arrival at Myola with an hour to spare before dark. McLaren kept a few orderlies at Templeton's Crossing to look after any new arrivals, who were held overnight and despatched early next morning. Wallman's team accompanied the stretcher patients on the journey to Myola, apportioning one orderly to each two or three stretchers.

Fortunately the supply of native carriers improved at this time, and Warrant Officers R. Preece and J. B. Davies of Angau were able to carry out the necessary arrangements with great success. They were able to allot a certain number of carriers solely for transporting casualties from the battalions to the nearest medical post. The only hitch came when word was received that air evacuation from Myola would not be possible. Oldham had held all patients there in the hope of planes coming in to Myola, but now it was necessary to instruct him to send on by road as many patients as possible. However, the brigade commander still hoped to hold Myola, and the medical services therefore hoped to continue successful care and movement of casualties in that area. This was of some significance to the morale of the force, especially as casualties might be expected in the battalions covering the withdrawal. The tactical difficulties in removing aid posts were evident also to the troops, for the carrier force was scanty and the natives tired, and at the high elevation of this part of the trail the cold nights inflicted hardships on all men not under shelter or without adequate cover.

The enemy attacked strongly at Isurava on the 30th, and in spite of assistance from the 2/16th Battalion the Australian left flank was broken. During the afternoon Potts had ordered a withdrawal to Eora Creek, but later, as the movement began, Lieut-Colonel A. S. Key and a number of his officers and men were cut off from the main body. Ten men were known to have been killed, and eighteen wounded; at that time many more were at least temporarily missing. It was known that the enemy was receiving reinforcements, and that he was using these to infiltrate round the Australian flanks. At this time the 39th and 2/14th Battalions held positions at Eora Creek. The headquarters and two companies of the 2/16th Battalion had reached the track near the brigade position, and the balance came through later, when the battalion maintained a position farther back. The brigade headquarters was mid-way between Alola and Eora Creek. The 53rd Battalion had been sent out of battle.

When the brigade commander arrived at Templeton's Crossing on 1st September he decided that Myola could not be held. Though the 2/14th and 2/16th Battalions held the direct route to Myola, there was a risk in the use of the alternative track by the Japanese. The brigade commander

instructed that all patients at Templeton's Crossing were to be sent on to Efogi as rapidly as possible, though time was not so pressing that patients could not be staged at Myola for the night. The carrier system remained the same as before, with a difference, that supplies and stretchers were now moving in the same direction.

On the night of the 1st there were over forty stretcher patients at Myola, and arrangements were made with the supplies organisation to have the use of carrier teams to transport the patients right back by stages to the roadhead at Uberi. Efogi, though over 1,000 feet lower than Myola, was in the zone where cold moist nights were still experienced, and was reached by hard climbing up and down to the Brown River Valley. This post was only for staging sick and wounded as they came back along the track.

Three medical officers with an ambulance detachment set up a post at Menari. When troops first passed through Menari it was a quiet and prosperous place with scattered villages, where peaceful Papuan folk were living their traditional life untroubled by war. But now, the aid post in Menari received in one day some 60 stretcher cases and 200 walking sick and wounded. These were examined, classified and dressed or otherwise treated as required. It was evident that as retirement continued and the ever-moving stream of sick men reached the lower levels of the trail their numbers would increase.

The general plan then adopted was as follows. Major D. W. Brummitt of the 2/6th Field Ambulance ran the post at Efogi for staging only, while the main post at Menari was run by Wallman and McLaren of the 14th Field Ambulance until they moved back, when Oldham of the 2/6th Field Ambulance took charge. A kitchen was set up along the Efogi track to feed patients and their bearers without their having to come into Myola, and the last patients to leave for Efogi were accompanied by Oldham early on the 2nd. All patients who were expected to be fit to return to their units in seven to ten days were to be held at Menari or at Nauro where the 14th Field Ambulance established posts. The medical post was withdrawn from Menari the next day, and set up at Nauro with facilities for surgery. This post had three medical officers and detachments from the 14th and 2/6th Field Ambulances. The supply problem was seriously discussed at this time, particularly in relation to the damage to supplies dropped from the air. Wastage was heavy, but a certain proportion could, it was thought, be prevented by more careful packing. On the 3rd, the 2/14th and 2/16th Battalions were covering the withdrawal from Myola, the 39th Battalion had moved on to the Kagi area, the 2/27th Battalion having then reached positions around Efogi.

EVACUATION OF CASUALTIES

While the troops were making a fighting withdrawal from the highest parts of the track over the range, arrangements were being made for the care of the casualties slowly passing down the trail towards the upper base area. A detachment of the 14th Field Ambulance had established a

staging post at Ilolo on the 7th August, and had first received battle casualties on the 18th. Now the numbers of sick and wounded were increasing. The first battle casualties seen there were men who had walked from the front line, but it was not until the 3rd September that the first stretcher cases arrived. Next day stretcher parties brought thirty-six sick and wounded, and the weather being dry at the time these men were transferred by trucks and motor ambulance from Newton's Dump[1] to Ilolo. The following day, the 5th, forty-two stretcher cases, twenty-five sitting wounded, and twenty-two sick were sent to Koitaki hospital (mostly men with malaria or exhaustion) and the infectious diseases hospital (men with dysentery).

Evacuation of the sick and wounded who left Myola was proceeding in accordance with the general plan. Since more travelling lay before the patients on stretchers they were made as comfortable as possible on leaving. Dressings were changed, new stretchers were made, and every patient left on a fresh stretcher, with four new blankets, a ground-sheet and a water-bottle, thanks to an improved supply system. All equipment was packed, and haversacks were prepared for use in staging patients at Myola. On the 4th Magarey left Myola for Efogi, where the 2/14th and 2/16th Battalions were staged for the night. He found their physical condition was poor: they were active and cheerful, though they were tired, and most of the men were having trouble with their feet.

Another and much more serious problem had arisen since the beginning of September. Mild diarrhoea was becoming increasingly more common, and this was one reason why three medical teams were held at Menari and Nauro, where there were also numbers of wounded needing surgical attention. It became evident that in spite of the intrinsically mild type of this disorder, the force was experiencing an epidemic of dysentery which had reached a rate of fifty to eighty cases per day. Sulphaguanidine was badly wanted, but there were no supplies. Only small supplies of magnesium or sodium sulphate were available, and these made little impression on the condition.

Battle casualties were being sent down by stages to the base, except in cases where surgery was urgently necessary, but all patients with dysentery were still being kept on the ranges. The need for great care in disposing of excreta was realised, but the difficulties in implementing this can be easily understood. It was impossible for all bearer parties to reach a main staging post before dark, and dawn found some still on the track. But in spite of these complications, by the time the last troops arrived at Efogi all sick and wounded had received attention and were sent on. Urgent requests were made of the A.D.M.S. for foot powder and spirit, and new socks and boots, and in the meantime massage and other general measures were adopted. Some medical supplies had been dropped from the air, but owing to the difficulty of communications between the brigade headquarters and the troops, little had reached the men. Natives of the

[1] Newton's Dump, otherwise known as Potts' Tea Rooms, was a post for refreshments four miles from Ilolo: its staff established an aid post for men in the area

supply line were still carrying stretchers to the headquarters, which was then at Menari. The strain was felt by all, though a quiet day at Menari was helpful. Medical officers, like others, were not immune to illness, and McLaren was sent back with dysentery and malaria.

The Japanese had taken Efogi on the 6th, and further withdrawals were necessary. The 2/27th Battalion was south of Efogi village and maintaining contact with the enemy by patrols. The men of this unit were forced to retire, taking casualties with them, and made a wide sweep through most difficult country towards Jawarere; nothing further was heard of them until the 21st.

Meanwhile, on the 8th, the Japanese outflanked the position of the 2/16th Battalion and cut off brigade headquarters from the battalion, leaving only an unreliable radio communication. The troops fought hard to extricate themselves from this position, and the situation was such that a few patients who were kept overnight at Menari were guarded by members of the A.A.M.C. armed with rifles. Oldham was instructed to cease holding patients and to send them all on; he and Wallman prepared to move to Ioribaiwa, and sent back 50 stretchers and 100 walking casualties to Nauro. The following day brigade headquarters and the 2/14th Battalion withdrew to Nauro; the 2/16th Battalion was still at Menari.

At this time communications were so poor that nothing was known at headquarters of what was being done with casualties in the battalions. All patients were cleared from Menari, and on the arrival of Colonel Norris at Nauro a team was sent back to form a staging post south of Nauro. Before dusk on the 9th, 104 sick and wounded had been dressed and fed there by Brummitt's party.

Major R. J. Humphery had now taken over from Magarey as S.M.O., and Oldham and Wallman had arrived at Ioribaiwa. It was difficult in the prevailing circumstances for field ambulances to control their detachments in the usual way. Hence Norris instituted the system of sending an A.A.M.C. major forward with brigade headquarters to control medical arrangements. This plan worked very well.

On the 10th the 2/14th and 2/16th Battalions were only 307 strong between Nauro and Ioribaiwa, but reinforcements from other units were moving forward. The next day the force began the withdrawal to Ioribaiwa, where the 2/14th and 2/16th Battalions were organised as a composite battalion, and orders were issued that this position was to be held. The Japanese made a strong attack, but made no gains. At this time the 2/27th Battalion was still out of contact, so too was part of the 2/14th Battalion, but the remnants of the 2/14th and 2/16th had been cleared of sick and wounded, and Brummitt's team moved from Nauro to Ioribaiwa as soon as all patients had passed through.

The lines of communication with the upper Moresby area now came under the administration of the 7th Division, and opportunity was taken to improve the hygiene in these localities. At intervals along the track from the forward areas to the roadhead, deep-trench latrines were con-

structed. At Uberi the ground all round the native village was badly fouled: this was burnt off, with the old huts, and the whole area was cleansed.

The 2/6th Field Ambulance began to relieve the section of the 14th Ambulance at Ilolo on the 6th. This relief was completed in two days, and the 14th was then able to gather its detachments, and staffed a dressing station for minor illness or injury, at a site on the road to the base area. This was of great assistance in handling minor casualties, as the hospital position in Moresby was still strained. Up to the 8th September 497 men passed through this staging post; of these 179 had gunshot or similar wounds, and 18 had disturbances of the nervous system.

The 14th Field Ambulance detachment, having been freed of forward duties by the 2/6th Ambulance, was also able to establish a car post on the Laloki River, and through this sent men from the aid posts back to the unit's M.D.S. The posts at Ilolo were under the charge of Lieut-Colonel F. N. Chenhall, the commanding officer of the 2/6th Field Ambulance, and here up to 100 patients could be accommodated with extra tentage should this be necessary. There was also an alternative evacuation route for patients. The rear headquarters of the 2/6th Field Ambulance was at Itiki near Koitaki, and the advanced headquarters at Ilolo where the M.D.S. was erected on a flat clearing, "a rare combination in this country" as Chenhall remarked, and staging posts were sited north of Ilolo at Owers' Corner, Uberi and Ioribaiwa.

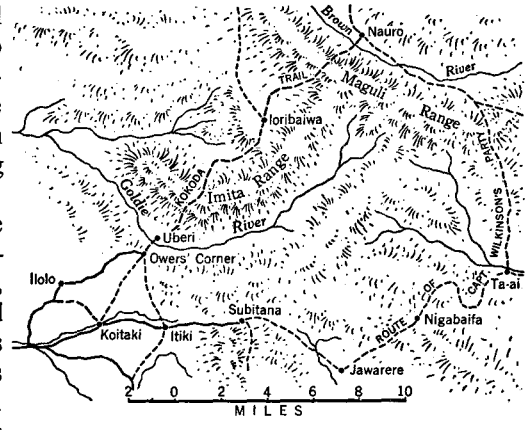
Arrival of 25th Brigade. The leading battalions of the 25th Brigade arrived in Moresby on the 9th September, and were coming up ready for action on the 14th. The whole brigade was equipped with uniforms of the new "jungle green" for the first time. Their arrival was welcome to the 21st Brigade, as the tired and depleted troops could now have some of the strain lifted. The medical services did not share so fully in these advantages, as the 25th Brigade arrived without a fully-staffed field ambulance in support. The 2/4th Field Ambulance arrived on the 17th, but, though very welcome, was not then up to full strength. This unit had detachments at Ilolo and Koitaki, and the 2/2nd Field Hygiene Section was also moving up to Koitaki. During the next week this ambulance established additional detachments in the Jawarere and Itiki areas.

Brigadier K. W. Eather concentrated the 2/31st and 2/33rd Battalions in the Ioribaiwa-Uberi area, and took over the command from Brigadier Porter. On the next day parties of the 2/14th and 2/27th Battalions, which had been cut off over a week earlier, began to arrive. By this time there were seen some of the signs of malnutrition among these soldiers, showing the risks of dietary insufficiency in this uncompromising country. This question of supplies and nutrition was of great importance at this stage in the campaign, for on this rested the ability of the troops to fight. There were definite shortages in necessary food supplies, as well as in drugs, and it is significant that medical officers have drawn repeated attention to this important factor in the conduct of operations.

WOUNDED FROM THE RANGES

The following episode is described in some detail, as it illustrates the difficulties in ensuring the return of wounded men to a rear post as close to the Moresby base as Ilolo.

Captain R. S. Wilkinson of the 2/4th Field Ambulance was sent to Subitana to establish a first aid post for the benefit of those members of the 2/14th, 2/16th and 2/27th Battalions who had been cut off, and were isolated behind the Japanese lines. Making a patrol along the Jawarere track he met a party from the 21st Brigade led by Captain J. Lee of the 2/27th Battalion, whose mission was to find and bring in isolated sick and wounded. Next day, on his own initiative, Wilkinson decided to attach himself to this party. After a night at Jawarere at an R.A.P. set up by orderlies of the 2/4th Field Ambulance, he helped them to move its site to a less malarious locality, and struggled with the orderlies up a steep and slippery mountain track to Nigabaifa. Here he left the patrol, so as not to hinder their progress, and went on towards Ta-ai next day, and spent the night wet, exhausted and alone. Lee's party had encountered a Japanese patrol and did not succeed in reaching any sick. They returned to Nigabaifa, where the natives waited for another patrol which they met after a couple of days at the foot of the mountain. Wilkinson joined one of these patrols under Captain J. C. Cuming and pressed on towards Nauro over the razorback mountains of the Maguli Range which they reached on 30th September in pouring rain.



Nigabaifa

As the location of the wounded of the 2/27th Battalion was not known, several tracks were explored unsuccessfully by various small parties whose rations were now very short. A local guide took them along a trail twice following the middle of a stream for 200-300 yards before crossing it, until finally they reached a village where the sick and wounded were waiting. Wilkinson described the meeting:

> They were naturally delighted to see us. The stench and the flies were terrific. The party had moved slightly to get away from the flies but they had followed. I was given two hours to work on them. Many of the blankets were fly-blown and I only had acriflavine to use on the wounds. The party had run out of dressings, fortunately we were carrying plenty. Altogether there were nine patients. Two of these were weak and malnourished after dysentery but could walk, the rest were on stretchers, and most of them were suffering from severe gunshot wounds.



(Australian War Memorial)

Wounded being brought in by native bearers on the Kokoda Trail.



(Australian War Memorial)

Native stretcher bearers on the Kokoda Trail.



Evacuation from Kokoda by Stinson ambulance plane which carried one lying and one sitting patient.

(Major A. O. Watson)



(Major A. O. Watson)

The Stinson ambulance plane which was used for evacuation of casualties from the Kokoda airstrip. A few trips were also made to Myola.



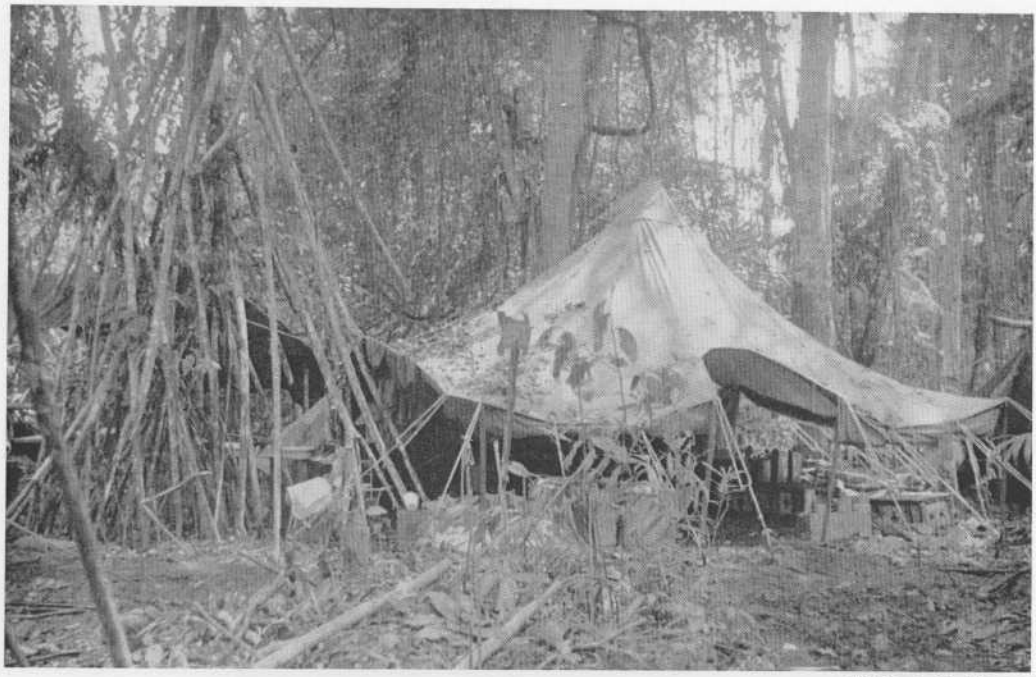
(Australian War Memorial)

Walking wounded at Oivi on their way back to the dressing station.



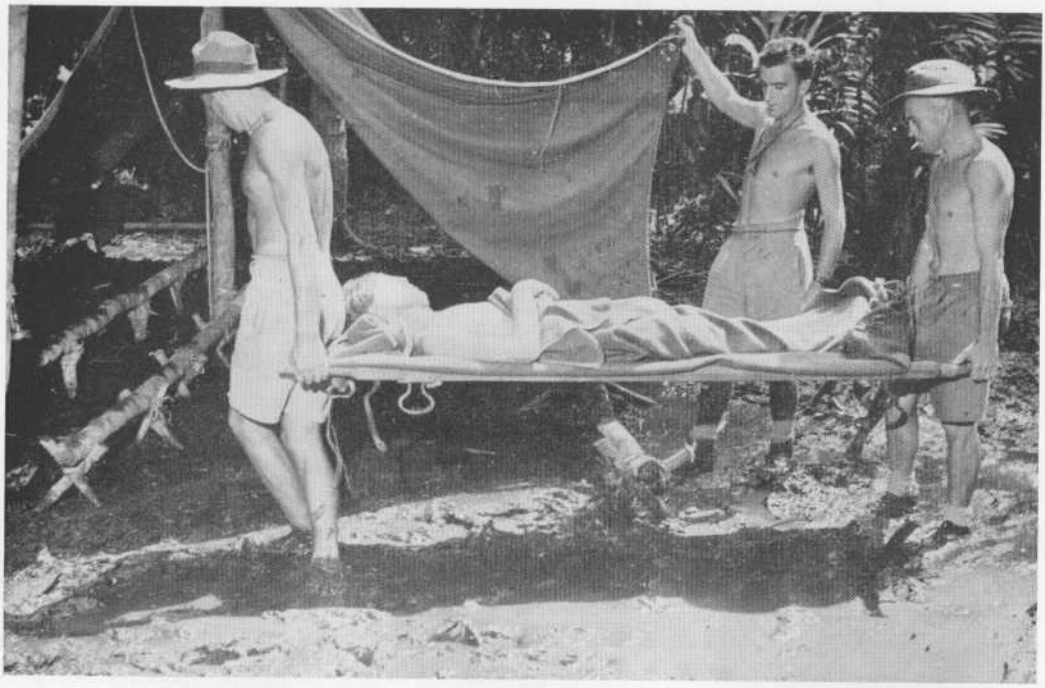
(Australian War Memorial)

Stretcher cases being transferred from a transport plane after evacuation from the Owen Stanleys. Compared with their trek over the Kokoda Trail which took days, the wounded have been flown back in as many minutes.



(Major A. O. Watson)

The operating theatre of the 2/4th Field Ambulance M.D.S. at Soputa.



(Australian War Memorial)

Main dressing station at Soputa.

The carriers adjusted the stretchers to their particular taste and we set off at about 1300 hours on our return journey. The going was slow but it was not long before the natives were doing their usual chattering and shouting when carrying stretchers.

Morphine was given to the stretcher patients for the first two days and dressings were changed when possible. By the fourth day of the return trip, the party was running short of food. The patients were washed and dressed. One man was not travelling well: he had an infected wound of the elbow, with a fracture which in the haste was only discovered after a day and a half on the road. Dried fern stems were used for a splint. Wilkinson sent the remainder of the party on, and stayed at the camp with the wounded man and some natives. Two days later three men of the patrol with eight carriers returned with supplies needed by the medical officer. On the seventh day the party reached Nigabaifa where they were met by two 2/4th Field Ambulance orderlies and were fed well. Spending the night here, next morning they set off along the slippery track to Jawarere and finally reached Subitana at dusk. From this point the patients were evacuated by ambulance and Wilkinson returned to his unit, the 2/4th Field Ambulance at Ilolo.

WITHDRAWAL TO IMITA

So the first phase of this campaign came to a close. During a brief period of pause the Japanese prepared strong defensive positions at Ioribaiwa, only some thirty air miles from Moresby. On 15th September they penetrated between the 2/33rd Infantry Battalion and the composite battalion, and although no real offensive action was achieved by the enemy, fighting was heavy, and there were some casualties. The commander therefore withdrew the 3rd, 2/25th and 2/31st Battalions and the 2/1st Pioneer Battalion, while the composite battalions 2/14th and 2/16th withdrew to Uberi. Spirited patrolling was maintained, and the positions of the Japanese were well explored, but otherwise the general position was static until the 26th.

The walking wounded from the Ioribaiwa area were looked after at the Salvation Army post for the night and sent on the next morning. There were posts established farther back by Captain W. Gove, and at Uberi by Captain Oldham. Through the whole of this movement back to Imita all but two of the wounded were evacuated; one of these men fell over a steep drop after a wound believed to be mortal, and the other was so badly wounded and in so inaccessible a place that he could not be removed. The native carriers brought stretchers up to wait near brigade headquarters, and went forward close to the aid posts when required. They showed great stamina and courage, even on the rare occasions when their exposure to mortar and shell fire was unavoidable. Only a few casualties resulted from the patrol activities, and access to most of the Imita posts was easy.[2] On the 26th, Humphery returned to the

[2] Australian casualties for Kokoda to Imita 22nd Jul-25th Sept: killed in action 24 officers, 307 other ranks; wounded in action 28 officers, 440 other ranks.

headquarters of the 2/6th Field Ambulance, after handing over to Major I. F. Vickery of the 2/4th Ambulance.

The proximity of the Japanese to Moresby, in spite of the drawbacks of their long and formidable lines of communication, represented a serious menace. On the highest military level this was clearly recognised, as could be seen by the arrival of considerable reinforcements of fresh troops in the defensive Australian positions on Imita Ridge. For a couple of months past Generals MacArthur and Blamey had brought their headquarters up to Brisbane, in much closer touch with the island base. The commander of New Guinea Force thought too that the nearness of Japanese troops to Moresby warranted the withdrawal of the Koitaki hospital and the convalescent depot to Murray Barracks. It is of interest that knowledge of the proximity of the Japanese in no way disturbed the equanimity of the convalescent patients. In further evidence of larger-scale operations ahead, American troops began to arrive in New Guinea in the middle of September.

MEDICAL CONDITIONS DURING THE RETIREMENT

The brief respite afforded by this gathering of forces permitted the medical services to review what had been done, and to plan for the future. On the difficult trail movement had been latterly almost continuous. From Deniki to the base, ten days' journey lay before a patient on a stretcher. Sometimes a twelve-hour day was necessary, even day after day, but the patients showed high endurance and arrived in remarkably good condition. Care had been taken to tighten up the record system, and to ensure that no unauthorised persons moved up and down the trail. Hygiene was more rigidly enforced, and measures taken to lessen promiscuous soiling of the ground. In the higher levels there were few flies, as a rule, though discarded rations attracted them, and at Myola blankets were often fly-blown. In addition there were ample opportunities for the passage of infection by hand, by food or by water. The troops became careless, and as the force grew and was more widely dispersed in small groups of men, further difficulties arose in feeding and in sanitation.

Limited accommodation for medical purposes was provided by Angau, in existing native buildings or others specially constructed with bunks in tiers when hessian could be obtained. Carriage of medical supplies caused difficulties in many ways. Large panniers were found too cumbersome for transport; small boxes, haversacks or metal ammunition cases were preferable. Only a restricted range of drugs could be carried, such as analgesics, anaesthetics, antiseptics, quinine, bismuth and sodium sulphate. Dressings and a set of surgical instruments were carried: plaster of Paris was a necessity, but like other materials used in quantity, was usually scarce. In these matters, the ready cooperation of Angau personnel with their apt control of the carrier force was invaluable.

Reports on the medical experiences of this phase of the Owen Stanley campaign were made by the medical officers concerned, and were of

great value, though it was evident that the after-history of the men treated could not be fully known at that stage. Of the 750 casualties successfully transported to the base area only four subsequently died in hospital. One of the chief problems was to arrange for casualties to be collected at some place where the conditions were sufficiently stable for them to be examined, classified, given treatment and rest before they were again passed on. Patients could not be held in any considerable numbers for long, and in their onward movements they were constantly handicapped by the inexorable factors of time and exhaustion. Often in fact they were reluctant to be moved on, but this could not be helped. Fortunately a high proportion of the wounded were able to walk, sometimes alone, sometimes with assistance.

McLaren reported that the high-velocity, small calibre Japanese bullet caused little fragmentation, and wounds of limbs, which were common, often did not produce serious structural damage. Compound fractures did well as a rule with conventional treatment by *débridement,* local sulphanilamide application to the wound, and fixation in plaster. The Thomas knee splint in a plaster gave good control of the lower limb, and firm bandaging of the cast to the trunk was satisfactory in the upper limb.

Injuries of the brachial plexus were common, and so also was suppuration due to retention of bullets, in spite of their high muzzle velocity. A few chest wounds were seen, and treated by aspiration with relief. It was thought likely that men with severe chest wounds did not reach medical attention: the same applied to those with abdominal wounds. Wounds of the face were usually superficial; few penetrating head wounds were seen. Wounds believed to be self-inflicted were reported; wounds of the great toe and left hand were said to be more common than other wounds of the extremities. In one battalion wounds believed to be self-inflicted fell from one per day to nil after all men so affected were sent back to the line. Yet, the other side of the picture should be stated, for other experienced medical officers believed true self-inflicted wounds were rare, or practically non-existent. In theory boards of enquiry should be held as promptly as possible; in practice this was always difficult and often impossible. Norris sent out written instructions that a wound was not to be labelled as self-inflicted unless the medical officer had actually seen the shot fired. There can be no question that some men were unjustly blamed, and as the experience of individual medical officers was often limited by circumstances, there can be no true statistical measure of frequency and general statements must be misleading.

The effect of malaria on the troops on the range was an important factor in wastage in the early stages, because the attacks were recurrent and not primary, except in troops who had been in the Kokoda-Oivi area. This was a handicap to the A.M.F. battalions which had previously had a high infection rate in Moresby. Anti-malarial measures were only possible in base areas behind Owers' Corner, but protective clothing and quinine were available elsewhere.

Respiratory disease was not uncommon in some areas in association with cold and wet weather: it appears to have been of the nature of a patchy bronchiolitis. On the northern side of the range the nights were always wet and bitterly cold, and warm and water-proof clothing was most desirable. Notwithstanding the hard conditions the men kept a good standard of general health, although nervous exhaustion was common, and was often associated with symptoms of functional type. Contributory factors were lack of sleep and sufficiently varied and satisfying food.

Exhaustion due to physical strain and exposure was significant, particularly during the withdrawal. While the force was advancing tired men could be kept and rested and then sent on to their units, but during the retirement the men had to be sent back. The policy was laid down that holding and treatment centres could only be considered at points two days' travel behind the troops in contact with the enemy. It was really only when the force was stabilised at Imita Ridge that holding posts forward of Ilolo became practicable.

In the early stages of this part of the campaign diarrhoea was almost universal, and was thought to be due to a mainly carbohydrate diet. It caused considerable loss of sleep but was otherwise benign. When more troops came up true dysentery appeared, with passage of blood and mucus and considerable prostration. Lack of hygiene was most evident along the lines of communication, where the lack of training in the troops in this important matter became evident. Anti-dysentery measures became fully possible when the force was concentrated at Imita. Such routines as water chlorination, the use of deep-trench latrines, incineration, fly-traps and fly-sprays were used in the concentration areas, but full facilities were not available. Supplies of sulphaguanidine became available at this time, and largely through the advice of Lieut-Colonel E. Ford the supplies held on the Australian mainland were gathered and sent to New Guinea. By the end of September it was in use at aid posts, and medical officers gave it to all men with signs of clinical dysentery. Six grammes were given as a first dose, and 3 grammes repeated at four-hourly intervals along the route, with the dual purpose of reducing infectivity of the stools and hastening recovery. The experiment of distributing a relatively scarce drug, as it was at that time, in so wide-spread a manner was bold and fully justified. It was packed in water-tight containers and later, for simplicity, was sent in powder form with a measure. Afterwards on the advice of Major R. R. Andrew, the dosage was lowered to 4 grammes as the initial dose and 2 grammes four-hourly as the clinical aspects remained mild. The most obvious results were the rapid relief of symptoms thus enabling exhausted men to travel, and even making it possible for officers to keep on duty. Captain L. H. Joseph who was in charge of the 2/6th Field Ambulance A.D.S. at Ilolo, reported that during the first three weeks of September, when the withdrawal to Ioribaiwa was in progress, some 1,200 casualties passed through, and that the majority of these men had dysentery. At this time the conditions were bad; refuse abounded

and flies were in myriads. Further, the only drugs then available were magnesium sulphate and chlorodyne.

Skin lesions were common, and were often due to the irritation of mite bites, with consequent scratching and infection causing ulceration. *Miliaria rubra,* the familiar "prickly heat", was troublesome also, particularly in the steamy lower elevations of the ranges.

Carriage and distribution of food were difficult, and intercurrent infections, particularly dysentery, also interfered with adequate nutrition. Most of the sick and wounded looked gaunt and thin on their arrival at base medical units. The risk of avitaminosis was increased when men were cut off from their base of supplies. Men of the 2/27th Battalion suffered from oedema for some six weeks after their return from a hard trek when separated from their fellows by enemy action. They also showed evidence of deficiency of vitamin *B* complex, and had diarrhoea which did not respond to sulphaguanidine. Men of the 2/14th, 2/16th and 39th Battalians also had symptoms of *B*1 and *B*2 deficiencies, which yielded to appropriate treatment.

The medical care of the native carrier force was controlled by Captain Vernon with the help of an experienced N.C.O. Brigadier W. W. S. Johnston, D.D.M.S. of New Guinea Force, was most anxious that every consideration should be given to the bearers, particularly in relation to their diet. In the early stages this was frankly deficient in vitamins, especially thiamin, as they had been eating polished rice. He recognised, too, the efforts of Vernon to secure for them adequate rest and blankets for cover at night. Vernon presented a consolidated report on the carrier force from July to October 1942. In this he pointed out that early in July he found the native carriers were in poor condition. After his appointment in charge of them, he at once instituted a service maintained by several Europeans and eight to ten native medical assistants. By the middle of August the service was more comprehensive, and the staging posts were adequately manned. He emphasised that the native carrier had a physique and constitution inferior to that of the soldier, and that medical selection was much less careful. On the other hand he knew the country and was inured to the physical discomforts of the terrain and the weather. There were three war casualties among them, one a death due to accident. Their chief medical disorders were malaria, diarrhoeal disorders and respiratory disease. Deficiency disease was apt to occur and demanded constant watchfulness. Malingering he described as widespread and subtle, and usually due to dissatisfaction with conditions. In this connection he pointed out that in the early stages their diet was deficient in meat, loads carried were often too heavy, and circumstances forced them to work too hard. Direct orders from New Guinea Force assured the carriers full feeding, tobacco, and regulation of loads and distances. Vernon was himself an admirable exponent of maintaining what he called "harmonious and almost fraternal" relations between carriers and soldiers. Soldiers did show selfishness especially in the early stages, but they owed much to the carrier force and freely recognised it.

CHAPTER 3

EVENTS AT MORESBY

AT the end of the first week in September 1942 the battle centres were moving closer to Moresby, and there was more medical work to do, partly in the care of the increasing numbers of troops, and partly in preparation for the expected increase in casualties from the Kokoda-Ilolo line. The 3rd Field Ambulance still continued in a static but highly useful role. The commander, Lieut-Colonel Gunning, was returned to Australia medically unfit, and the unit was commanded in the interim by Major R. N. C. Bickford, and later by Lieut-Colonel J. N. Freedman. The work at the infectious diseases hospital at Lux Lane continued, and Brigadier Johnston decided to extend the unit's work to the handling of men who needed additional care at a rest camp before being drafted to the convalescent depot. Opportunity was taken also to arrange for dental attention by the 256th Dental Unit under Captain P. Stephens.

Further hospital accommodation had been needed at Moresby for some time, and there had been a good deal of discussion on the question of the best site. On 23rd August the 2/9th A.G.H., which had been temporarily in South Australia, arrived in Port Moresby. Colonel C. E. Wassell had retired from the command through ill health, and was succeeded by Colonel A. H. Green. Plans had been made *en route* for the correct unloading and transport of stores, and for the setting up of accommodation and essential services. On arrival, Green found that final selection of the site had been made only the day before, when the scrub on the area was burned, leaving a smouldering blackened surface over the undulating contours. The members of the unloading party, without the advantages of an advance section or assistance other than that generously offered by the staff of the 5th C.C.S., dumped their stores as best they could, and were glad to avail themselves of the use of tents of the C.C.S. for quartering and feeding the working parties. The site was intersected by erosions between steep hills, which sometimes formed torrents after heavy rain and flooded the wards. The area was too undulating for the making and use of a simple sketch map, but with the engineers' help some detailed planning began. One reason for the choice of this area was the possibility of extending the piped water supply from the C.C.S.: however, five weeks passed before more than one line was available, and over 600 patients were held before a supply was laid on. Ten days after arrival at the site the hospital was admitting patients at the rate of forty-six per day. These trials were in part at least a reflection of the more urgent stresses being imposed on the medical units in the Moresby area.

During the next three weeks after hospital work had begun 920 patients were admitted; there were 605 beds equipped and 560 occupied. Eighty-four beds were set apart for patients with dysentery, which was still preva-

lent in the Moresby area. On the hospital site itself the sanitation was unsatisfactory for some time. Latrines took six days to build, could not be constructed fast enough to meet the requirements of an expanding hospital, and flies were prevalent. Surgical work was much hampered by the lack of a proper operating theatre; steel prefabricated huts had been promised by Land Headquarters, and had arrived, but were used for other purposes, in spite of protests, and as a result the theatre was completed for work only two months after the arrival of the hospital.

It was soon evident that one 600-bed hospital was insufficient to cope with rising requirements of illness and injury. At the beginning of September Green suggested that the simplest way would be to expand the 2/9th A.G.H., to 1,200 beds, and bring up another 600-bed hospital from Australia, but permission was only given to increase the establishment to 800 beds, on 29th September. It was not until this date that the engineering services were able to start work on the wards, as they hitherto had been engaged in surveys, and planning and work on water reticulation and the operating theatre. At the end of September and beginning of October the unit was warned that the nurses were being sent up. At this time the unit was admitting at the rate of a 1,200-bed hospital, and the commander pointed out that this rate would increase by reason of additional facilities for surgery, growing numbers of troops and the advent of the malarial season. When additional services called for by this expansion were being planned Green succeeded in having the plans framed to allow for a further increase to 1,200 beds. One native-type hut was used experimentally as a surgical ward, and another later for physiotherapy, and work was begun on extra wards. Before even the full expansion to 800 could be achieved, an acute demand for beds compelled the hospital to provide extra bed accommodation by putting ambulance stretchers under beds.

The medical and nursing problems which arose in the 2/9th A.G.H. were greatly accentuated at this period of its work in Moresby by the fact that no members of the A.A.N.S. or A.A.M.W.S. had been permitted to accompany the hospital, because of doubts in the stability of the military position. This threw a great strain on the male orderlies and on the medical officers who had to perform, or at least oversee, many technical procedures that would otherwise be carried out by nurses.

The total hospital beds available in New Guinea amounted to only 5 per cent of the force, which when compared with the 8 per cent of Middle East could not be considered adequate. New Guinea Force had steadily expanded in August and September. Whereas in July there were three infantry brigades, there were now, in late September, nine: the 7th and 18th at Milne Bay and the 14th, 16th, 21st, 25th and 30th Brigades, and the 126th and 128th United States Regiments round Port Moresby or in the Owen Stanleys. It must be realised too that hospital beds available included the beds held and used in field units and convalescent depots. The 3rd and 14th Field Ambulances and the 5th C.C.S. were all largely immobilised and many of their beds subserved the purposes of a hospital.

Their purely medical work was greatly assisted by the attachment to the C.C.S. of a mobile bacteriological laboratory which carried out pathological examinations, particularly for malaria and hookworm. The work of supplying the growing needs of the Infantry Training Battalion and the Infectious Diseases Hospital imposed a continued strain on the 3rd Field Ambulance in addition to its other duties. The 14th Field Ambulance was already committed to the maintenance of the detachment which accompanied the force on its way back from Kokoda, and had also a detachment at Ilolo. As soon as the withdrawal to Ioribaiwa was complete the 2/6th Field Ambulance set up an M.D.S. at Ilolo with staging posts forward. This relieved the 14th Ambulance of some of the work, and this unit was directed on 18th September to establish a dressing station at Lux Lane, and a staging post at Ilolo-Koitaki road junction. The dressing station was designed to take patients from the M.D.S. at Ilolo, and from the 2/4th Ambulance's A.D.S. at Subitana, and also from the aid posts of the 14th Brigade. From this A.D.S. men were transferred to the camp hospital or to the 3rd Ambulance's hospital for infectious diseases.

The 46th Camp Hospital, originally the "base" hospital of Moresby, had also developed in new directions and had two offshoots, for patients approaching or undergoing convalescence. One of these extensions was in buildings at Rouna near the falls on the Laloki River, formerly used as a Red Cross convalescent home, the other occupied the plantation buildings at Koitaki.

The convalescent depot at Koitaki, like most places in the neighbourhood, carried a considerable malarial risk, but it had the advantage of a cooler, airier location than King's Hollow, where the buildings were shut in and hot. On 16th September, the military position on the range had deteriorated and it was decided to withdraw the hospital and convalescent depot at Koitaki to a safer area closer to Moresby. From a restful convalescent home Koitaki became a centre of great activity, and the numbers of sick and wounded passing through increased so that Captains L. S. Davies and B. N. Adsett had to clear the patients as quickly as possible so as not to hold up the stations and posts established at Ilolo and other places near the roadhead. Later when Koitaki became more secure the buildings were again occupied by a medical unit.

When the 113th Convalescent Depot was also able to return to its original site in the base area, Major Thorp expanded his unit considerably, and its work, carried out conveniently close to the Moresby installations and the posts at the Moresby end of the Kokoda Trail was of the greatest value to the increasing Australian forces in New Guinea.

Disposal of Patients. The evacuation of patients to the mainland or even from forward to base areas raised very intricate problems. From the beginning hospital accommodation was not easy to arrange, and it was essential to have enough hospital beds available, not only to secure attention for sick, but also to ensure that men were not sent back to the mainland unless the severity and probable duration of their illness warranted it. Transfer to a distant hospital meant loss of men for an indeter-

minate time. In point of fact they were virtually lost to their units and formations.

The actual method of travel to the mainland was usually by sea, for aircraft were scarce. The United States forces with their greater facilities used air transport more than the Australians. There were several difficulties to be overcome. The planes used were generally transport aircraft making a return journey from Moresby, and only suitable for ambulant sick and those able to look after themselves. Otherwise attendants were needed who had to be returned to Moresby by air or sea, and who could ill be spared from medical units. Later, sheer numbers emphasised the need for a wider employment of both sea and air transport. By sea the ideal method was by hospital ship, but this was not always practicable, nor could the available ships supply enough beds. Sea ambulance transport was very valuable, though the dearth of medical attendants limited the use of these ships for patients ill enough to need personal care. Great help was often given by the United States medical services in the provision of medical officers and orderlies to staff sea transports. The actual transfer of patients to the ships was usually difficult to organise. The expected time of arrival was always somewhat indefinite and was often changed, even several times, and the stay in port of both hospital ships and transports was usually brief.

Medical Boards. Many of the practices found helpful in the Middle East had to be learnt afresh in New Guinea. The first important step was to ensure that the initiating of boarding should be a function of the medical service. The number of boards held was for a time increased by men in the older age groups who were now feeling the strain of service in the Middle East, or elsewhere since their return to Australia, and also by members of militia units whose physical standard was not good and who had not stood up to operational training, to illness or to actual fighting. One passing difficulty was that the militia units in Australia adopted different categories of medical classification to those used by the A.I.F. in the Middle East: eventually the latter became the standard.

Later all medical boarding was done at the 2/9th A.G.H. where the work was carried out promptly and efficiently. Much routine boarding was saved by the encouragement of consultation. At the 2/9th A.G.H. and 5th C.C.S. the opinion of consultants and specialists was obtainable by special arrangement. It was also particularly helpful to the D.D.M.S. to have the opinion of senior physicians and surgeons as to the advisability of returning patients to the mainland.

Dental Work. Lieut-Colonel M. S. Joyner acted as A.D.M.S. Dental for New Guinea Force, and in spite of the difficulties engendered from troops' movements and shortages of supplies contrived to serve the needs of the rear areas. In Moresby and neighbouring areas prosthetic work was carried out in considerable volume, and conservative dentistry likewise. The dental sections were allotted in proportion to the concentration of troops available for dental work, and dental officers on the strength of medical units helped to maintain oral fitness as far as this was possible

with such a quickly moving population. In forward areas only urgent work could be done, but as has always been the case, dental officers collaborated with surgeons in various technical procedures, some not directly related to oral surgery, but nonetheless valuable.

Medical supplies and stores. The limitations of sea transport in Townsville and the dearth of wharf space and dock labour at Moresby caused many delays. Transport by air was also slow and unreliable, owing sometimes to insufficient labelling of packages, or to breakdowns in the method whereby incoming material would be placed in dumps where it might lie unrecognised. This gave Townsville a reputation as a bottle-neck. There were also risks of pillaging, which were believed to be considerable during transit by sea.

The distribution of stores was carried out by the New Guinea District Depot Medical Stores, a unit which arose from the dispensary of the 46th Camp Hospital. After the arrival of the I Australian Corps the 2/4th Advanced Depot Medical Stores, under command of Major F. R. Matyear, a unit with valuable experience gained in the Middle East, absorbed the previous establishment, and settled in at a convenient location near the 2/9th A.G.H. and 5th C.C.S. From here the corps was supplied under conditions of the greatest difficulty, and in addition the base establishments in Moresby, and large quantities of medical material were also sent to Milne Bay. Supplies were promptly packed and despatched whether by ship or by small coastwise craft, by plane or for dropping from the air, or by carrier, and the work of this and similar units during the war in the islands was a vital link in the work of the medical services.

Hygiene. The cause of hygiene in Moresby was handicapped from the first, by reason of the difficulties in educating partly-trained troops, the lack of experienced staff, and the state of transition of the hygiene service. Captain J. L. Groom, commanding the 16th Field Hygiene Section had an uphill task in securing that degree of cooperation with the troops and others comprising the mixed population of Moresby at that time, and when the corps arrived there, the D.D.M.S. described the state of sanitation as deplorable. With this problem was also that of malaria control. Major S. A. McDonnell, the D.A.D.H. Corps, combined with Groom to improve control, and after a town major had been appointed some headway was made. Colonel Blank, the American base surgeon at Moresby, was also thoroughly in agreement with the principles concerned.

The Australian medical officers found that, as in previous campaigns, the real difficulty in such matters was getting down to the individual man, his conscience, his discipline and his performance. By cleaning up dumps and refuse, burning and burying tins of other waste, erecting deep-trench latrines and imposing disciplinary measures on both Australians and Americans, success was gradually gained, evidenced by a striking fall in the incidence of dysentery. McDonnell was further handicapped by not having the 2/2nd Field Hygiene Section; this unit was on the mainland in process of being disbanded in accordance with the new hygiene system which was being introduced into the army. In the middle of September

the problem of dysentery prophylaxis was made more important by the withdrawal of the Australian troops to Ioribaiwa and Imita Ridge.

An increasing body of troops was now concentrating within a short distance of Moresby, under conditions not likely to foster hygiene, and pressing down the Kokoda track towards Moresby was a powerful Japanese force, which would certainly bring with it a trail of dysenteric infection. There was too a real risk of the introduction of the potentially serious Shiga type of dysentery, which would increase the wastage of men already feeling the strain of the arduous campaign. This was an additional reason for active preventive measures; it has already been pointed out how important it was to keep Moresby as a military base free of communicable disease.

In the beginning of October when elements of the 6th Division began to arrive in Moresby the A.D.M.S., Colonel H. M. Fisher, made severe comments on the general hygiene of the area, and reported to the divisional commander that disciplinary action would be necessary to cope with carelessness in disposal of tins and food residues, and with slackness in dress. The personal support of the G.O.C. Corps, Lieut-General Herring, was of great help in establishing higher standards.

Malaria prevention was hampered by lack of material. This was a serious matter in Milne Bay, and in Moresby also there were grave shortages. For example, fair supplies of malariol were to hand, but there were not enough sprayers. Ford, McDonnell and Groom had succeeded in carrying out malarial surveys, and the dangerous areas were known where mosquito breeding was intense, and where the native splenic index was high. They also gave much advice and instruction on specific problems, and travelled round the area. In this way much laxity was disclosed and strict measures were taken to enforce orders.

Water. The Laloki River supplied the Moresby area, and apparently this water communicated no infection to the great number of men who drank it unsterilised, in spite of its opportunities for contamination. The impetuous rush of the Laloki from its upper rocky levels might, it was suggested by optimists, supply enough aeration to purify the water, but experience of other sparkling streams was not always so favourable, as apparently clean water would sometimes contain organisms of the *coli* group. The plan thought desirable was chlorination at the pumping station at Bomana, but the chlorination of water by individual units was practical and reliable provided the material was obtainable. Away from base areas, and in particular on the Owen Stanley Range water must often have been contaminated. Here the only practicable method was the use of individual sterilising outfits, but these were not always on issue.

Combined Operational Service Command. This organisation was established at an opportune time, and its medical section, with Lieut-Colonel R. H. Macdonald as A.D.M.S., was able to take over more and more details of administration in the base and line of communication areas, thus freeing the D.D.M.S. for work on wider aspects of policy and forward planning. The arrangements for sea transport of sick and wounded were

early taken over by C.O.S.C., and later the land transport to the ships, and control of the general and camp hospitals was overseen by this organisation. This had the advantage of coordinating Australian and American hospital arrangements.

AUSTRALIAN NEW GUINEA ADMINISTRATIVE UNIT (ANGAU)

The prompt formation of this unit was a most important step. It was not only necessary that the organisation of the natives should be designed to help the cause of expelling the invader from New Guinea, but also that their well-being should be constantly considered for the sake of the present and the future. The medical objects of the unit were to maintain the health of the native population, and to place the health policy on a firm basis of preventive medicine. A health directorate was formed comprising a medical service with sections concerned with nutrition, malaria control and hygiene. Native field hospitals were run by European medical assistants, with the help of native orderlies with variable degrees of training, and efforts were made to increase the knowledge and capacity of these men. Many of the medical assistants, though unqualified medically, had attained a high degree of practical skill, and had the advantage of special training in Australia. In operational areas hospitals were established to serve task forces which operated throughout the Territories.

The more seriously ill patients were transferred to base areas, but immediate treatment was given as far as possible to the natives employed by the army as carriers or in other operational duties, and also to natives in the villages. Central hospitals in each region undertook the treatment of diseases causing a significant morbidity, such as tropical ulcers and yaws. These services were supplemented by missions which maintained hospitals and treatment centres; some of these employed qualified medical practitioners and nurses. Further mention will be made from time to time of the medical work of Angau. In the present instance the outstanding operational contribution of Angau was the undertaking and maintenance of the native carriers on the Owen Stanley Range, who formed the life-line of supplies and medical evacuation, and who needed the guidance and help of those who understood them. The first senior medical officer appointed to the administration was Captain N. V. McKenna, who had had experience in New Guinea before the war. Close liaison between the D.D.M.S. of New Guinea Force and Angau was maintained, but it was soon apparent that the S.M.O. alone could not carry the great responsibility of being the only qualified medical officer, and that the medical section of Angau would have to expand.

OTHER FIELD UNITS ARRIVE IN MORESBY

On 2nd October the 2/2nd Casualty Clearing Station, commanded by Lieut-Colonel J. H. Stubbe, arrived in Moresby, and set about establishing the unit at Koitaki. The plantation buildings there had been used previously as a sort of annexe to the 46th Camp Hospital, and it will be

recalled that this establishment had been disbanded when the enemy approached too close for security. Now the opportunity was seized to increase the accommodation and resources at Koitaki by putting Stubbe's unit there. The plantation buildings were supplemented by tents, and on the 6th the first patient was admitted, after which the numbers mounted rapidly. As we shall presently see the military position had now changed. Fresh troops had come in, tired men including some of the medical units were relieved, and the greater stability of the Moresby area gave a good background for a large and important medical base.

The 2/1st Field Ambulance, commanded by Lieut-Colonel D. A. Cameron, accompanied the 16th Brigade when this element of the 6th Division arrived, and at first was engaged in training, with particular reference to methods and extemporisations used in the war on the ranges. Small sections were equipped for the formation of small medical posts, with certain additions to the usual items, such as sulphaguanidine and pentothal. A little later an M.D.S. was opened to serve the 14th Brigade, and an A.D.S. on the river bank near Bomana airfield. Later again this unit was able to play a useful part in a hospital role, chiefly in the handling of men with malaria.

The 113th Convalescent Depot, after a rather uncomfortable period at the Murray Barracks, was allowed to return to its previous location in the Sogeri Valley as from 7th October, and there resumed its usual work.

UNITED STATES PARTICIPATION

General MacArthur directed that an initial force of one regiment would advance over the mountains to strike the Japanese force on the Kokoda Trail in the rear. Accordingly, early in September, after discussion with General Rowell, Brigadier-General Hanford MacNider sent a small advance reconnaissance party by an alternative route from Rigo, some forty miles south-east of Port Moresby, on to the southern slopes of the Owen Stanley Range. A few weeks later a detachment of the 126th Regiment followed, and a week later the rest of the battalion.

The main body arrived at Jaure on 22nd October without making contact with the Japanese, but the track was so arduous that the remainder of the regiment was not sent forward. At Jaure the force split, and turning to the north, one detachment crossed the divide and continued along the Kumusi River to Wairopi and thence towards the coast. Another party made a detour over the Girua River and finally reached Popondetta. The bulk of the battalion struck eastward to link with an American drive from south of Buna; the rest of the Americans participating were flown across the mountains, and their further activities were in relation to the operations on the plains east of the range.

CHAPTER 4

MILNE BAY

MILNE BAY was included in a district of which Samarai, on a small island in the China Strait was the capital. This district comprised the tail of New Guinea, the expansive Goodenough Bay, a number of large islands and island groups of which Goodenough Island was of some tactical importance, the Louisiade Archipelago, and Milne Bay with its dominating position at the south-east tip of New Guinea, and its natural harbour and deep-water frontage. The military area of Milne Bay was restricted in size: the bay was roughly twenty miles long and eight to ten miles wide, and the land area was some ten miles by three miles of low swampy jungle ringed by mountains on three sides with the sea on the fourth side. This irregular area of flat land was cut off by spurs of the Owen Stanley Range on the south, rough groups of mountains on the west, and the Stirling Range with its heavily wooded sharp ridges and deep gorges standing as a barrier on the north. The area held coconut and rubber plantations, now considerably overgrown, and among numerous sago swamps ran creeks and small rivers whose rapid streams readily flooded in the wet season. It had a high annual rainfall averaging 108 inches, and a hot, very humid climate.

The area of operations was confined to a shallow strip of country along the northern side of the bay running eastward from Gili Gili, where there were limited landing facilities. Here there was a jetty which ran into deep water some fifty feet from the shore, but only ships of moderate size could approach to load or unload even with the use of pontoons. A narrow road wound up a slight rise to a copra factory.

The flat part of the Milne Bay area was low-lying; none of it was higher than 20 to 100 feet above sea-level. There were a number of creeks and small streams rising from the spurs beyond, but only one sizable river ran into the head of the bay. After heavy rain, especially in the wet season, these soon became fast and deep torrents. Most of the roads were narrow and unsuitable for heavy vehicles and many were impassable in the wet. Near the mountain barriers thick jungle impeded progress; in many places the flat ground near the coast was covered by dense vegetation, in others swamps were even more formidable hazards. Road access to the wharf area at Gili Gili was reasonable; only one airstrip was practicable at that time and this was approachable by road from the jetty; both the other strips were incomplete, and only one was accessible after heavy rain. In bad weather the road running eastward close to the shore was only passable to four-wheel-drive vehicles. Numbers of creeks were bridged, but the bridges were of light construction and not suitable for heavy military transports. Access to Milne Bay by air was sometimes held up by low cloud or bad weather.

In times of peace the plantations and missions might carry on their usual activities without undue hindrance, but the establishment of armed forces introduced serious problems of transport, hygiene and sanitation, and supply.

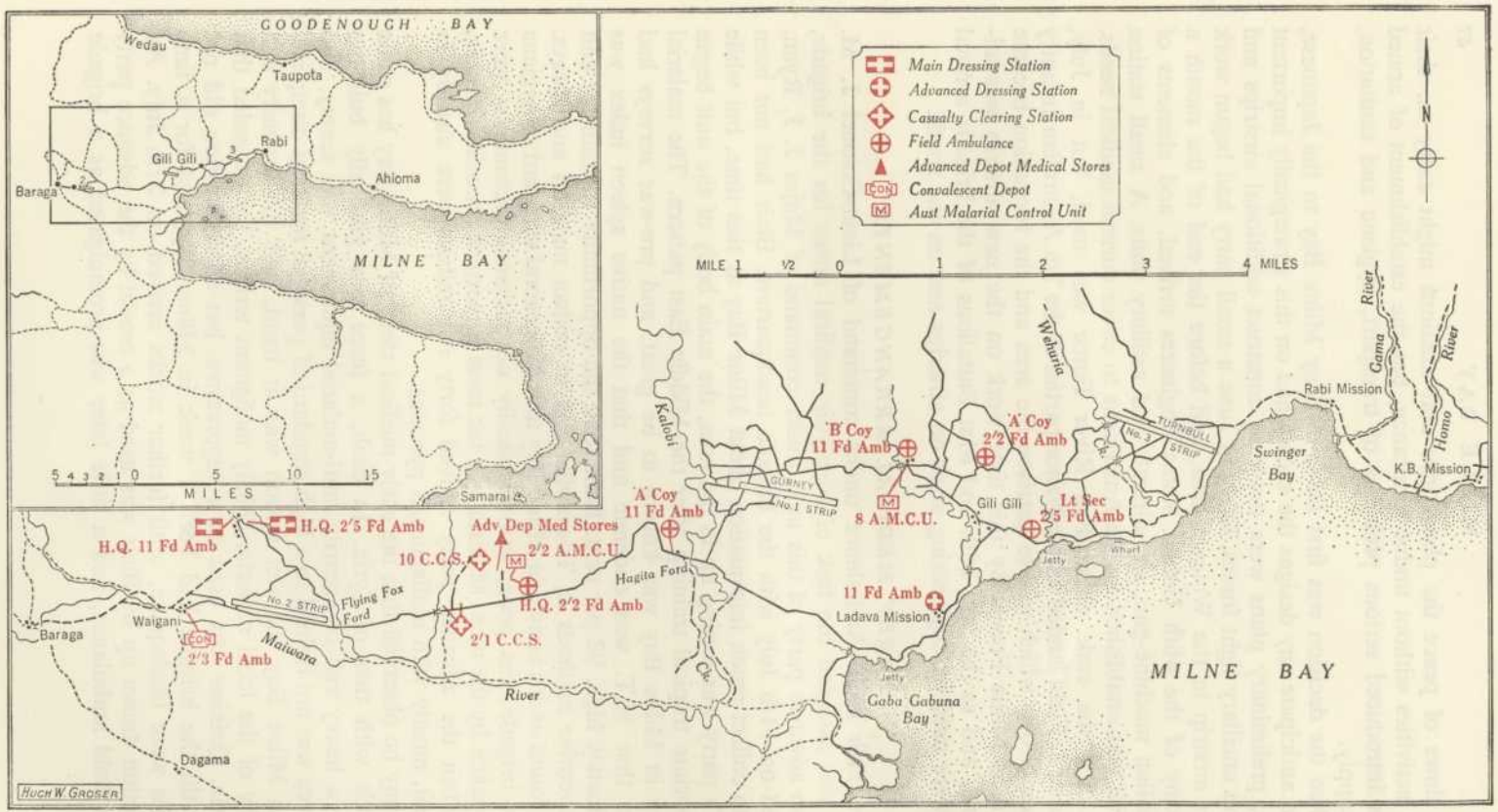
When the decision was first made to deny Milne Bay to the Japanese, and to anticipate any designs the enemy had on this strategically important place, preliminary plans were made to construct additional airstrips and to land ancillary light forces. Early in June a small party had begun work on an airstrip in the Waigani area, and before the end of the month a company of the 46th United States Engineers arrived, and elements of Australian machine-gun, anti-aircraft and artillery units. A small station hospital was established by the Americans to cover current medical needs.

At first the code name Fall River Force was used, but in July, Brigadier J. Field landed with advance parties of the 7th Australian Infantry Brigade Group which was to garrison the area and the formation became known as Milne Force. By this time work on the new airstrip was advancing, and as the 9th, 25th and 61st Battalions of the brigade arrived they were used on engineering work on airstrips and on the roads.

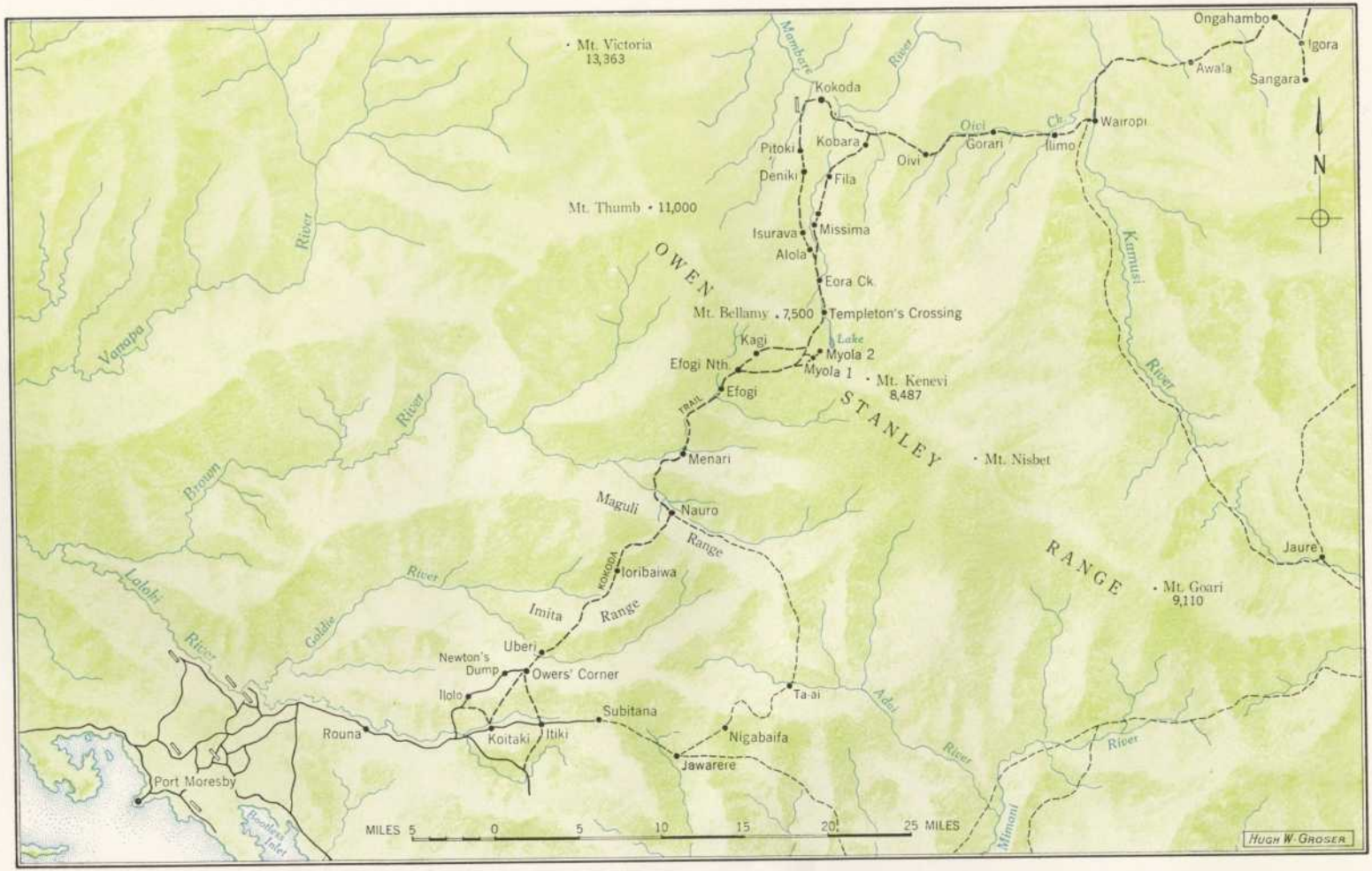
EARLY MEDICAL ARRANGEMENTS

The 11th Field Ambulance under command of Lieut-Colonel J. M. Blair was assigned the task of supplying medical cover for the brigade, and an advance party of this unit, under command of Major J. J. Ryan, arrived on 11th July with the brigade headquarters. Blair had not been able to collect much information about Milne Bay at this time, but while Ryan's party was setting up in the area, the main body of the unit began appropriate tropical training after the Middle East pattern. The malarial hazard in Milne Bay was known to be great, and pre-war surveys had shown that M.T. was endemic and that the native spleen index was inordinately high, 92 per cent. Blair took the opportunity to train his unit in preventive methods in Townsville and to collect malariol and sprays. Ryan found on his arrival in Milne Bay that the general standard of hygiene in the brigade was poor, and practically no personal precautions were being taken by the men. Malaria was the most important prevalent disease, and when the advance party arrived forty Australians were already in hospital, mostly with undiagnosed pyrexias.

It may be observed that the early medical story of Milne Bay has some parallels with that of Syria. In each, a force was gradually built up under a heavy veil of security, anti-malarial equipment was scanty, and the force was not trained to a high standard of personal malarial discipline. But in Milne Bay the wet season was at hand, and the intensity and severity of the local malaria, chiefly malignant tertian, far exceeded that of Syria. Quinine was used as a suppressive, but administration did not begin till the brigade had been a week in Milne Bay, and for a time supplies were inadequate, until further stocks arrived on 27th July. An instruction drawn up by Blair was used as a model by the advance party of the field ambulance, and a little later was promulgated as a brigade


GOODENOUGH BAY
Wedau
Taupota
Gili Gili
Rabi
Baraga
Ahioma
MILNE BAY
5 4 3 2 1 0 5 10 15
MILES
Samarai
Main Dressing Station
Advanced Dressing Station
Casualty Clearing Station
Field Ambulance
Advanced Depot Medical Stores
Convalescent Depot
Aust Malarial Control Unit
N
MILE 1 ½ 0 1 2 3 4 MILES
Weburia
Kalobi
Gama River
Homo River
Rabi Mission
'B' Coy 11 Fd Amb
'A' Coy 2/2 Fd Amb
'A' Coy 11 Fd Amb
8 A.M.C.U.
Gili Gili
Lt Sec 2/5 Fd Amb
TURNBULL No. 3 STRIP
GURNEY No. 1 STRIP
Swinger Bay
K.B. Mission
H.Q. 11 Fd Amb
H.Q. 2/5 Fd Amb
Adv Dep Med Stores
10 C.C.S.
2/2 A.M.C.U.
H.Q. 2/2 Fd Amb
2/1 C.C.S.
Hagita Ford
No. 2 STRIP
Flying Fox Ford
Waigani
Baraga
2/3 Fd Amb
Maiwara River
Dagama
11 Fd Amb
Ladava Mission
Jetty
Wharf
Gaba Gabuna Bay
MILNE BAY
HUGH W. GROSER

Milne Bay



Kokoda Trail

instruction. This laid stress on the personal use of suppressive quinine in daily dosage of 10 grains, and the wearing of protective clothing, and on the methods of adult and larval mosquito control. However, there were no nets available for use when the force arrived, and very little protective clothing: the men wore shorts and had their sleeves rolled up.

Ryan's advance party set up an M.D.S. in the Waigani area, near the site of the brigade headquarters, which was later moved. An A.D.S. was also established at the Ladava Mission. On 2nd August the remainder of the field ambulance arrived at Gili Gili; its headquarters took over the M.D.S. at Waigani; having prepared huts and sheds for this purpose, "B" Company moved to a neighbouring location. Patients were being received on the 6th, and by the time the main body of the unit arrived, there were fifty-six patients in the M.D.S. and thirty-six in the A.D.S. Circumstances demanded that the unit should devote much of its time and activity to running a hospital, thus losing a degree of mobility. Nevertheless during August malarial squads were set up in battalion areas, adult mosquitoes were vigorously attacked by spraying, and in the ambulance unit a high personal standard of precaution was enforced.

There was now a force of over 6,000 in the Milne Bay area, and on 4th August just as the Nos. 75 and 76 R.A.A.F. Squadrons arrived, the Japanese showed signs of activity by an air raid directed largely at these formations. A week later the Zeros returned but met a prompt and effective counter-attack.

A third airstrip had been planned in the Gili Gili area, running down towards the water, and the 43rd United States Engineer Regiment brought in modern equipment to accelerate construction work. Supplies of fuel were also laid down at Goodenough Island and Wanigela on the north coast. The force was consolidating its position, and reinforcements were expected. It should be noted that on 7th August a United States marine division landed in the Solomons, under cover of sea attacks by American and Australian naval units. A bitter struggle for Guadalcanal began, and all naval participants suffered losses. This began a naval war of attrition to decide the fate not only of the Solomons but New Guinea.

MORE TROOPS ARRIVE

On 12th August the 18th Brigade A.I.F., under command of Brigadier G. F. Wootten, began to arrive in Milne Bay, and with it came advance parties of the 2/5th Field Ambulance, commanded by Lieut-Colonel J. S. Crakanthorp. The next day Major-General Clowes and his staff, including Colonel G. B. G. Maitland, A.D.M.S. of the force, arrived by air. The force was now officially Milne Force, with Clowes as the General Officer Commanding. Maitland had previously been acting as A.D.M.S. of New Guinea Force; Lieut-Colonel Gunning had temporarily carried out these duties. As part of the changes being rapidly made to cope with the threatening situation facing the force based on Moresby, the Headquarters of New Guinea Force was being taken over by the staff of I Australian Corps, translated from the mainland.

Before leaving Moresby, Maitland was able to simplify the mechanism which had previously demanded that all men transferred for medical reasons to Australia should be submitted to a medical board. This had thrown an unnecessarily heavy burden on the medical officers who had been hard pressed by pioneer work, but the whole question was to become more urgent, as it was an indication of the serious importance of sick wastage. This was but one of the problems that awaited Maitland in Milne Bay. On the 13th, the day on which the G.O.C. and staff arrived, a patient died of malaria in the M.D.S. of the field ambulance, an omen of what lay ahead. It may be noted that already the treatment standardised in the area for clinical infections followed the lines of that laid down in the A.I.F. in the Middle East: three days quinine 10 grains daily, five days atebrin 0.1 gramme daily, and after three days rest, five days of plasmoquine 0.01 gramme daily. It is interesting that the cyanosis and abdominal pain in some patients drew the attention of the medical staff to the fact that the dose administered contained twice the prescribed quantities of plasmoquine base. This had happened in Palestine also, but once the importance of a chemically exact dose was generally recognised, no real trouble was encountered. Malarial diagnosis was also put on a sound basis at an early stage, and thick films prepared with Field's stain were being used in the 11th Field Ambulance.

THE SCENE ON ARRIVAL OF MILNE FORCE

Maitland's medical command was complicated by his having no D.A.D.M.S., and no office staff other than a borrowed officer from "A" Branch. Even his personal effects and stationery had gone astray, and a large supply of anti-malarial pamphlets specially printed before the force headquarters left had been sent in error to the 7th Division. Communications with Moresby were defective and the demand was considerably greater than could be met by existing facilities. Messages to and from Moresby did not always arrive. Anti-malarial stores expected from the mainland had not appeared, and protective clothing was not available to more than a small proportion of the men.

The most troublesome problems facing the A.D.M.S., and indeed the whole force, were the weather and malaria. The headquarters of Milne Force found conditions in the area difficult and uncomfortable in the extreme, especially as the time for preparation would probably be short. Heavy rain fell persistently and the narrow-crowned roads ran between deep wide ditches in which vehicles were readily bogged. Detours were equally treacherous, and heavy trucks left deep ruts in the soft mud in which following vehicles were brought to a standstill. Only four-wheel-drive trucks could negotiate some roads, and the worst tracks were quite impassable. Siting medical units was a difficult matter; access was a problem, so too was hygiene in low-lying areas, where the sub-soil water was close to the surface. Streams flooded with heavy rain, fords became dangerous and then impossible of transit.

The dispositions of Milne Force were as follows: the 7th Brigade was sited in the eastern part of the Gili Gili area; the 9th Battalion a little to the south round Gaba Gabuna Bay, the 25th Battalion north of No. 1 strip, and the 61st Battalion with the 2/5th Field Regiment to the west, with detachments some miles along the bay to the east of K.B. Mission and Ahioma. The 18th Brigade was responsible for the western part of Gili Gili and the No. 2 strip at Waigani. Near the brigade headquarters west of the 61st Battalion was the 2/10th Battalion in reserve, and under command of the 7th Brigade. The 2/9th Battalion was south of the No. 1 strip at Hagita House and the 2/12th Battalion at Waigani. The brigade headquarters was near the Milne Force headquarters between No. 1 and No. 2 strips.

The medical units had to be sited in accordance with these locations, but this was not simple, owing to the bad weather and the paucity of good camp sites; in addition some movement of the original A.D.Ss. was necessary as they were not well placed for tactical requirements, and were perforce holding patients.

Under depressing conditions of the wet season the forward party of the 2/5th Field Ambulance moved to its site in the neighbourhood of the 11th Field Ambulance. The A.D.M.S. obtained thirty native labourers through Angau, and the housing of both ambulance units proceeded. By 18th August the whole of the 2/5th Ambulance had moved into the camp area. The M.D.S. was set up within a quarter of a mile of the M.D.S. of the 11th Field Ambulance: nearby was also the American station hospital, in a house. The 2/5th M.D.S. was planned to take men with infectious diseases. Both ambulances were confronted with the physical difficulties of providing adequate accommodation for the sick with reasonable roads of access. Torrential rain fell on the 19th, and the 2/5th camp area was awash. The sites selected for wards were under water. With effort the area was drained and tents erected; cookhouse shelters were built by natives. Water supply was, paradoxically, a problem: it was obtained by catchment from tent flies, from which it was caught in a water cart or other receptacles. On the 21st conditions were even worse; six inches had fallen during the night and the two main fords (Hagita and Flying Fox) were impassable.

Three transports arrived in the harbour, carrying among other troops the staff and equipment of the 110th C.C.S. under command of Lieut-Colonel F. L. Wall. After some difficulties in the consignment of the unit's ordnance and medical stores, the C.C.S. had left Brisbane excellently equipped. It was, as its commander said "a whittled-down 600-bed general hospital, and carried extra surgical equipment, a pathologist, and fully equipped pathological laboratory—anti-malarial gear such as mosquito helmets, mosquito ointment, flysol, fly-sprays and knapsack sprays". Fairley arranged for the commanding officer to have 200,000 tablets of quinine, to be carried by hand. The members of the staff had also been well instructed and drilled in therapeutic and preventive procedures. The unit went to a staging camp at Gili Gili, and two days passed before it was

possible for Maitland and Wall to reconnoitre the proposed site. Ten inches of rain fell while the ships were being unloaded, and many stores were dumped in the mud and ruined. No carton packings, even with the protection of boxes, could withstand the weather. Unfortunately no hypodermic needles, lumbar puncture needles or oxygen adaptors had been sent, and mosquito nets were not readily accessible, being packed in bulk.

FINDING SITE FOR C.C.S.

Milne Force headquarters officially began administration on the 22nd. Next day Maitland and Wall inspected the plantation site proposed for the C.C.S. It was covered with long kunai grass, and the approach led through a marshy area marked on the map as Sago Swamp. It was still flooded by the swollen river. While Angau arranged for a hundred natives to help in the preparation of the site for the C.C.S., further reconnaissance of the whole area was made, but nothing better could be found, and the natives began clearing the undergrowth. A few days later Maitland again visited the area, partly by Bren carrier, partly on foot, but on returning to the headquarters he found that hasty packing was proceeding. News had been received that the Japanese were about to land troops in the Milne Bay area. The headquarters of Milne Force hastily moved to a new site, and it was necessary to transfer "A" Company of the 11th Field Ambulance to a new position with its patients.

This news was not altogether unexpected, for sea movement had been observed, and there had been some air activity: on the previous day Japanese fighter planes had raided the area, and had lost four planes. Little time had been available for the preparation of field medical units for action. The 11th Field Ambulance, longest in the area, had managed to construct part of a road leading into the unit; the 2/5th Field Ambulance had only been a fortnight in Milne Bay, and was already forced to move some of its component parts, while the 110th C.C.S. was striving to have enough gear brought to the sodden site to make a kitchen and quarters for the men, and to erect marquees to house some thirty hospital beds. The tents were camouflaged with mud and leaves; but lacking further protection from the water, other stores were dumped on the 2/9th Battalion area, which was forty or fifty feet higher than the C.C.S. site. The approach road was impassable on the 25th, and the warning of a Japanese invasion came on the following day. The surgical section was promptly erected on the battalion area without any specially designed lay-out, the generator was hauled in by a Bren carrier, and an operating theatre was ready for action after twenty hours' labour. The C.C.S. thus occupied part of the 2/9th Battalion area, largely though perhaps not entirely by force of circumstances. "Small, muddy and irregular as it was, there was no better spot for the treatment of the battle casualties." These arrangements were made barely in time, for during the night of the 25th-26th the Japanese made a landing on the northern shore of Milne Bay eight miles east of Gili Gili.

Towards the end of August Milne Force included for the purposes of command some 7,500 members of the A.I.F. and A.M.F., 600 of the R.A.A.F., and 1,350 American troops. The medical establishments included two field ambulances, only one of which had been even as long as three weeks in the area, and a casualty clearing station which had just arrived. Maitland now had the temporary help of Captain T. K. Whiting as D.A.D.M.S.

ACTION

On the 24th, enemy landings were reported east of Buna on the north-east coast, and the next day landing barges were observed off the south-west coast of Goodenough Island. Later on the 25th an enemy convoy escorted by three cruisers was sighted off Kiriwina 140 miles from Milne Bay. A detachment of the 61st Battalion which had been posted at Ahioma, several miles east of the K.B. Mission at the head of the bay, was recalled by water, and in returning encountered Japanese landing barges. A ketch was lost and the party, unable to proceed, had to make its way back to the battalion by a long detour overland. A little later, at one o'clock in the morning of the 26th, patrol vessels discovered ships in Milne Bay, and shortly afterwards an enemy force landed at Ahioma. Early contact was made with the Japanese by part of the 61st Battalion. There were some casualties and little headway was made before the Japanese withdrew.

The first battle casualties reached the 11th Field Ambulance before noon. This unit had its M.D.S. carrying out the functions of a hospital, and by the 27th had eighty beds occupied. The other field ambulance, the 2/5th, had its "B" Company ready to move for tactical purposes, and had been warned to be ready to work as a hospital within twenty-four hours. The 110th C.C.S. had fifty beds equipped on the 27th, was receiving casualties, and had started work in the operating theatre, with two surgical teams. The American station hospital had 100 beds ready, of which forty were occupied. It was clear that more beds would be needed to allow the ambulances to perform their normal duties, but as the A.D.M.S. observed as soon as he landed in Milne Bay, the need to hold patients was already immobilising units which should be free to move.

Late on the night of the 26th a strong Japanese force attacked the two companies of the 61st Battalion, which withdrew to the west to Rabi Mission, and the 2/10th Battalion, also under the 7th Brigade, was sent forward. The following day Japanese planes attacked No. 3 airstrip and later enemy land forces made a night infantry attack. In this they used a flame thrower, but the Australians dealt with it by grenades. Captain R. G. Lyne, R.M.O. of the 2/10th Battalion, was seriously injured and two A.A.M.C. men were badly burnt when a carrier slipped off the road on to a mine. Lyne died soon afterwards, in spite of prompt resuscitation measures. Replacements of the medical officer and men were supplied from the staff of the 2/5th Field Ambulance. During these days the medical units were hard pressed by their efforts to consolidate their posi-

tion: it was a problem to provide the sheer means of living and working as well as to handle casualties.

Difficulties of transport were extreme; even immediate access of stretcher patients to the hospital wards involved toil. Bringing in casualties from No. 3 airstrip on the 27th was a difficult and arduous task in which the 11th Ambulance bearers participated. The 2/5th Ambulance placed a relay station at the end of an access road, and changed patients from ambulance waggons to four-wheel-drive trucks. By this time casualties were being received by all the units.

In the dark early morning of the 27th the Japanese delivered a heavy attack on the Australian flank and the 61st Battalion withdrew to the Gama River. The 2/10th Battalion was now sent up towards K.B. Mission in relief of the 61st Battalion, whose men had now been two days and nights engaged in heavy fighting. Signs of fatigue were evident in those who were admitted to dressing stations. The Japanese, as usual, attacked again at night, using two tanks, but although the Australians had no effective anti-tank weapons, the enemy did not break through. Late in the evening, even with the help of supporting artillery, the battalion was pressed back to the Gama River.

At 2 a.m. on the 29th the Japanese made a great effort, and pushed past the 2/10th Battalion, which in a delaying action had its headquarters and two companies cut off. These could not make contact with the rest of the unit and were forced to make a long detour through the foothills. Only after some days of hard travelling by the companies was the battalion reunited. The Japanese encountered the 25th Battalion, which was defending the airstrip with the assistance of American machine-gunners, but were not able to penetrate to the strip, and withdrew at daylight. On the night of the 29th, the 25th and 61st Battalions were waiting on the strip for the usual night attack, but the enemy did not engage the defenders; their tanks were bogged in the formidable mud, and were abandoned. The 2/12th Battalion was moved forward from Waigani in anticipation of a forward move by the 18th Brigade, but the discovery of enemy ships in the harbour caused postponement of the plan, and neither side attacked on the 30th.

Meanwhile MacArthur at General Headquarters was perturbed by the progress of the action, and directed that a prompt clearing of the northern part of Milne Bay be undertaken. The troops in the area did not share this pessimism, in spite of hardships and bad weather. Cautions were given to the units in the medical area lest their safety and that of their patients might suffer through infiltration by the Japanese. All units camped on the jungle's edge were instructed not to sleep within fifty yards of the undergrowth and arrangements were made for withdrawal in emergency. The American station hospital was responsible for the safety of the medical area, and on the night of the 28th gave an alarm, but no action was found necessary. While action was pending there was cause for uneasiness, as there was little to indicate whether the Japanese would come overland or by sea landing, or where they would first appear. The 110th C.C.S. was

really outside the defence area, and only protected by a listening post. Naval bombardments experienced in the later stages of the action were uncomfortable, though they did little damage; one medical commander stated to his men that they "could be regarded with contempt". Great vigilance was maintained at night, with no smoking, no lights, and no noise. Good unit discipline was found to be essential for efficiency, shaving was insisted upon, proper dress was worn, meal parades were held; the general atmosphere was one of calm.

During the relative lull at the end of August the weather was very bad. On the 29th twenty-five patients in a truck had to be towed into the 2/5th M.D.S. by an American tractor. This unit supplied an A.D.S. under command of the 18th Brigade when an advance was imminent and was moved to Milne Force headquarters under Major J. O. Lavarack. The units were perforce used in an unconventional way. The 11th Field Ambulance evacuated to the 110th C.C.S. for surgical purposes, but after operation patients were, when practicable, passed on to the 2/5th Ambulance for further holding. The 11th Ambulance held 172 patients on the 30th; its daily average was 155. The exact disposal of patients was to some extent at the mercy of the weather. Trouble was still being experienced with water supply in places. The M.D.S. of the 2/5th Field Ambulance was inadequately served, and creek water had to be carried for cooking and washing. Accommodation was still sketchy: native huts were available for some wards, but the 2/5th Ambulance used a tent for minor surgery. Rations were short at this time; for two or three weeks this unit had little but biscuits and bully beef, and a little marmalade. Ingenuity also produced "reasonably good bread" from jettisoned flour and fermented coconut juice. About this time two cases of scrub typhus were recognised in the area, the forerunner of more at a later date.

In spite of the unconventional set-up of the medical units, medical and surgical demands were met. Among the varied duties of the C.C.S. was the issuing of stores to other units, as the functions of an advanced depot medical stores unit had been added to its unofficial establishment. The task was more difficult because of shortages in such essentials as shell dressings, vaseline, sulphanilamide and morphine. The surgeons of the C.C.S. had to cope with considerable difficulties from the beginning of the action. Sufficient instruments, anaesthetics, and dressings, had to be found in the packed cases, which bore no external indication of their contents. It was only a happy discovery of trucks bearing the unit's colours on a siding near Brisbane some time previously that enabled the C.C.S. to act as a surgical unit. Serum and apparatus for resuscitation were located and unpacked just in time to treat Lyne and the other casualties from an exploding land mine. Fortunately a supply of vaseline gauze was sterilised as soon as the autoclave was working. The two surgical teams did not alternate, but worked simultaneously, using common material and sleeping when they could. Major C. O. F. Rieger led the teams, though ill himself at the time. The placing of the surgical section in the area of the 2/9th Battalion gave rise to some difficulties. The infantry insisted

on a scrupulous blackout but were never satisfied with it. Consequently the hot steamy congestion of the closed marquees was very trying. Wounds were mostly severe, as the predominance of stretcher cases showed; enemy bombs and machine-guns at close range produced the most serious injury.

On the night of the 30th-31st the Japanese again heavily attacked the airstrip, which was covered by the 7th Brigade. The 2/12th Battalion, which had already moved up, advanced towards the K.B. Mission, and continued to advance on 1st September. An enemy night attack on the Gama River was repulsed, and the next day the battalion continued to press on. Brigadier Johnston visited the area the following day to see conditions at first-hand, as some of Maitland's reports had not reached him. The weather conditions on this day were shocking. Both M.D.Ss. at Waigani were cut off by floods. Flying Fox ford was under seven feet of water, the neighbouring small bridge was broken, and the relay post held five casualties who had been rescued from a ten-wheel truck submerged in trying to cross the ford. In discussing affairs with Maitland, Johnston agreed that the strength of medical units should be brought up to establishment, that the 110th C.C.S. should be established on its correct site as soon as practicable and that a site for another C.C.S. or a hospital should be prepared. The surgeons of the 110th C.C.S. had performed ninety-six operations in seven days.

Transport of patients from forward posts gave great difficulty. Captain B. Hooper of "A" Company 11th Field Ambulance established an aid post at Rabi Mission with the 2/12th Battalion along the east coast. At first, casualties were moved by bearers following up the battalion, but later water transport was used; for this purpose ketches were employed with stretcher bearers under a bearer officer. Twelve patients were brought back by water while the Japanese were firing within a mile of the A.D.S. The risks by road were hardly less: on the 3rd a three-ton truck failed to reach the ford at all because of the innumerable deep holes in the road, which was broken away on both sides and was part of a morass of impassable tracks. The C.C.S. was experiencing so much trouble in transferring patients to the M.D.Ss. that on 31st August the A.D.M.S. had been forced to direct that no transfers be made for the time being.

Part of the 2/9th Battalion was sent on 3rd September by sea from Gili Gili to reinforce the 2/12th Battalion at K.B. Mission. Strong opposition was encountered, but the Australians occupied the position at nightfall. The next day again saw hard fighting by the Australian troops against firm Japanese resistance. In these engagements the advanced dressing stations were of great value, and worked well with the unit bearers. In one instance a patient was brought in by boat to the 2/12th R.A.P. needing urgent attention for a major abdominal wound, and was promptly taken on in a commandeered truck. The A.D.S. at Gili Gili did particularly good work during the time of the naval bombardment of the night of the 3rd-4th. This shelling of the areas east of K.B. Mission did little military damage, and was presumably a covering action, as the enemy resisted strongly the further attempts of the Australians to advance east

along the foreshores of the bay. Two days later the 2/9th Battalion continued its onward movement, but met with no organised resistance, and occupied the former Japanese base with little trouble.

Meanwhile the medical units were expecting the hospital ship *Manunda,* as battle casualties and sick were now imposing considerable burden on their temporarily limited resources. At this time there were 365 sick and 164 battle casualties held in the medical units. *Manunda* left Brisbane on 2nd September and arrived in Milne Bay in the late afternoon of the 6th and, fully lit, anchored two miles from Gili Gili wharf, where the M.V. *Anshun* was lying. During the night a Japanese cruiser and a destroyer drew in and, after inspection of *Manunda* with searchlights, shelled the wharf and aerodrome area. The *Anshun* was sunk with a quantity of valuable stores, but no hostile gesture was made to the *Manunda.*

The next morning the hospital ship was unable to berth because of the sunk vessel, but the ship's crew and unit staff collected 182 patients in life-boats, and then hoisted these up to "C" Deck, and thence carried the stretchers on board. The *Manunda* was carrying the personnel, stores and equipment of the 2/1st C.C.S. and during the afternoon all were disembarked by the laborious process of towing loaded pontoons by the life-boats. This work could not be completed till the next day, when some assistance was available from some American negro labourers. That night a Japanese cruiser again shelled the shore areas, but did not interfere with the brightly lit *Manunda.* While the remainder of the C.C.S. material was being landed on the afternoon of the 7th enemy bombers appeared. A bomb fell in the water about 600 yards from the ship, and the *Manunda* drew out from the wharf area and later left for Port Moresby. It was not practicable to unload the remainder of the stores of the C.C.S. and some six slings of equipment were left on the ship when she sailed.

Meanwhile, on shore, unorganised bands of Japanese stragglers were being encountered as far east as Ahioma, and their destruction signalised the end of the action in Milne Bay. It was realised that the Japanese naval forces in the bay had covered withdrawal by sea, and that though there were still scattered troops trying to make their way overland to Buna, the Japanese land forces had suffered their first defeat.

During the last six days the two battalions involved had lost 200 killed and wounded, and the total Australian battle casualties now numbered 373; of these twenty-four were officers. These losses were regrettable, but they were more than offset by the wonderful lift of morale by the decisive defeat of the Japanese force. An insidious enemy still remained in the malaria which was expected to declare itself as the flood rains subsided. There was hardly a problem which did not press for solution. Siting of units, provision of accommodation, transport and stores still needed much hard work, quite apart from the setting up of measures of hygiene and of malaria prevention, a vast labour in themselves. Without these the attrition of the force could become alarming and even lose Milne Force the fruits of victory. Knit by an even firmer bond, the force had now to make Milne Bay safe from another enemy—disease.

CHAPTER 5

OWEN STANLEY CAMPAIGN: IMITA TO WAIROPI

THE second phase of the campaign on the Owen Stanley Range began after the withdrawal of the Australian forces to Ioribaiwa in the middle of September. The move to Imita Ridge was complete by the 17th and on the 23rd General Blamey arrived in Moresby. On this day the military dispositions were as follows. In the forward area Major-General A. S. Allen commanded the 7th Australian Division, with the 14th, 21st and 25th Brigades, the 14th Brigade being relieved by the 16th Brigade. In the rearward area was the headquarters of the 6th Australian Division, commanded by Major-General G. A. Vasey, with the 30th Australian Brigade and the 128th United States Infantry Regiment. The 126th United States Infantry Regiment was then arriving at Moresby.

A relative lull lasted from the withdrawal to Imita Ridge until 26th September. During this period active patrols probed the Japanese force, which, though depleted, was engaged in constructing strong defensive positions with reinforced earthworks at Ioribaiwa. It is important to realise that during this lull, significant events were happening elsewhere, notably the rapid and spectacular clash of arms at Milne Bay, where the expected attack by the Japanese had culminated in a trial of strength under conditions of extreme difficulty. Also in the Wau-Bulolo-Salamaua sector Kanga Force had been carrying out exploring and harassing tactics against the Japanese. Little was undertaken in the way of offensive operations in the Wau area, but buildings and equipment on the goldfields in the Bulolo Valley were burnt and abandoned as part of the tactical defence of Moresby.

From the medical point of view it should be clear that the Owen Stanley campaign, for all its fluctuations, was a continuous chain of actions, in which the effects of disease were all-important, that the conquest of the Japanese at Milne Bay was only the beginning of a long struggle against endemic and epidemic malaria, and that the expected Wau-Salamaua operations would also be bound up with the struggle against tropical disease. Therefore we take up again the story of the tasks demanded by preventive medicine all along the lines of communication over the relentless mountains and down on to the steaming malarious plains below.

ADVANCE FROM IMITA

Full advantage was taken by the Australian force of its stabilisation on Imita Ridge. Fighting patrols explored the enemy positions, and these had been under fire from 25-pounder guns which had been brought up to Owers' Corner after great effort. On the 25th a patrol penetrated a little distance into the enemy's position on the main track to Ioribaiwa, and the next day a heavy attack was launched on the Japanese front and flanks by three battalions. Further advances on Ioribaiwa showed that

the enemy had withdrawn, and on the 28th, when the position came into Australian hands, the main body of the Japanese had retreated, and only a rearguard was left, retiring rapidly along the trail northward.

This altered the medical position, as with the expanding scope of work aid posts were now needed forward of Ilolo. The advancing Australians found that the retiring Japanese did not concentrate for a stand until they had reached Templeton's Crossing. Fortunately the weather had remained dry for sufficient time for 25,000 pounds of material to be shifted from Moresby to Owers' Corner. As the Australians advanced, however, there was a bout of bad weather which hindered air-dropping and made recovery of stores more difficult. In spite of this the Australian force captured Nauro on 30th September, took Menari on 2nd October, and finally on the 3rd, occupied Efogi with its high-pitched village huts and its cold wet nights, a foretaste of the chilly mist of the higher places. By the 6th the force had reached Kagi without encountering any Japanese except in isolated straggling parties.

In accordance with these advances the 2/6th Field Ambulance was moved from Ilolo to Uberi on 2nd October. The 2/4th Field Ambulance, which had been fostered at Ilolo by Chenhall's unit, and had taken opportunity to become familiar with the country, took over the M.D.S. at Ilolo a few days afterwards. This dressing station was then taken over in turn by the 14th Field Ambulance, so as to allow Lieut-Colonel A. F. Hobson, with his 2/4th Ambulance to be freed of work at the Subitana aid post, and to go forward to Nauro. The conformation of the country here was rather more favourable to air-dropping than some other places. The area was flat and lay in a wide valley, but after heavy rain it soon became a morass. Some supplies were sent by road in divided loads, and some were dropped from the air.

The 2/4th Ambulance began to prepare an M.D.S. at Nauro, off the track, and the 2/6th established an M.D.S. at Uberi. Owing to the speed of the Japanese retreat, neither of these posts functioned fully. A detachment under Captain A. V. Day was left at Nauro to look after some sick and wounded, and later rejoined the main body of the unit, which had meanwhile pushed on towards Myola. The 2/6th Ambulance followed the 2/4th a few days later. As these two ambulances went on to Myola, the intermediate posts were taken over by detachments of the 14th Field Ambulance.

By the 9th Joseph and his party of the 2/4th Ambulance were at Myola, Sergeant F. N. Smith and orderlies were at Kagi, and an N.C.O. and detachment at Efogi, while Day was at Nauro with a detachment. The work of the medical services was, of course, full of frustrations, particularly for the R.M.Os. for with supplies being carried from Owers' Corner, replenishment was barely possible.

Hobson, with Majors H. F. G. McDonald and G. C. Love pressed on to Myola, and on an area known as Myola 1, selected a site for an M.D.S. Sixteen tent flies from a local dump were erected before dark. This enabled Major G. V. Mutton, acting as R.M.O. of the 2/33rd Bat-

talion, to be relieved next day of the necessity of holding casualties. It may be remarked here that it was on this day, the 11th, that the first wounded were received at Ilolo since the advance from Ioribaiwa; these men arrived in good condition after a six-day journey.

Meanwhile, the Australian forces had moved on from Templeton's Crossing, where the great gorge, carrying the fast-running Eora Creek was entered after a severe climb over a very rough track. Templeton's Crossing was five days' march from Ioribaiwa. During the second week in October strong patrolling contained the enemy within his main defences, and during the period 13th to the 16th heavy frontal and encircling attacks by the 3rd, 2/25th and 2/33rd Battalions were successful in capturing the objectives with severe enemy losses.

Myola was the goal for settled medical work on the range until Kokoda was taken, and on the 13th the evacuation plan provided that no casualties should be moved back from Efogi, so that they could be held at Myola for direct air transport to Moresby, or, failing this, sent on foot to Kokoda and, when it fell, by air thence to Moresby. The 2/4th Ambulance was becoming more firmly established on the 13th, and Captain D. R. Leslie of the 2/9th A.G.H. and Captain A. O. Watson, the dental officer acting as anaesthetist, were expected there as a surgical team. More tents were dropped at Myola on the 15th and picked up at once; patients were received despite an acute shortage of gear for cooking, eating and drinking, which called for some extemporisation. Further ingenuity used biscuit tins as dixies and helmets as bed-pans. A steady stream of patients, both sick and wounded, arrived through the day, and by dusk 75 patients had been admitted, 34 being battle casualties. This number had been increased to 130 by the next day, and as the surgical team had then arrived, the first operation was performed soon afterwards. Towards evening Chenhall arrived with thirty-one O.Rs. from his unit. The most unsatisfactory feature of the day was the low percentage of recovery from air-dropping: this was chiefly due to the type of the country; most of the packages were lost in the forest, and no cooking gear was obtained.

On the 17th a 2/6th Ambulance party moved to the Myola 2 area, two hours' journey distant on foot, and began to establish an M.D.S. there, while Hobson's party with six officers worked on at Myola 1 in a primitive theatre made from a tent fly and blankets with some still more primitive equipment for sterilisation. When night fell there were 133 men in hospital; their only light was two hurricane lamps and two torches. More staff appeared the next day, and the Menari post was now ordered to close and the personnel to come on to Myola.

On 18th October the 25th Brigade followed up the successful attacks delivered some days earlier, and carried out an assault on the enemy position at the first crossing at Eora Creek, but failed to dislodge the Japanese. The 16th Brigade relieved the 25th in the forward area, and followed up the attack. Hobson moved with the 16th Brigade headquarters as medical liaison officer on the 19th, when this formation established a position half an hour's travel behind the ground south of the

stream held by the enemy, and began a series of attacks which lasted for several days.

More medical help was needed at Myola, and all the available staff at Uberi was summoned forward, while the 14th Field Ambulance supplied their replacement.

Both brigade headquarters and the aid post were on a slope exposed to mortar and mountain-gun fire. During the afternoon of the 22nd a mortar bomb hit the R.A.P. of the 2/3rd Battalion, killing two orderlies and the medical officer's batman, and wounding the medical officer Captain M. Goldman. The position was difficult; hot drinks could not be safely prepared for the men, as smoke attracted mortar and gun fire, and water had to be collected during the usual afternoon storm, as the Japanese held the ground near the creek. This situation was unchanged on the 24th, and Love set up a post at Templeton's Crossing, and Wilkinson was in relief at the 2/3rd Battalion aid post.

At Myola medical forces were strengthening; Joseph arrived there from Efogi, where he had run a staging post and looked after troops in transit. There was no definite news as yet of the chances of air evacuation from Myola, when the 2/6th M.D.S. began to take patients: Leslie took up duty at Myola 2 as surgeon, while Vickery and McDonald carried out surgical treatment at Myola 1. Arrangements were made for the fragile portion of the 2/6th's equipment, some 700 pounds, to be taken to Myola. The admissions back at Uberi had now dropped to small figures, and authority was given for all medical personnel at the staging posts to move forward to Myola.

On the 27th a patient was transferred by air from Myola to Moresby. It was evident that there would be increasing need for surgical treatment at the hospital centre at Myola, for the Japanese held strong positions facing the 16th Brigade. Joseph was brought up to the native camp south of Eora Creek, and set up a medical post. There was particular need for essential drugs and dressings, as Hobson found the brigade supply was almost depleted. Inevitable delays occurred in the sending and arrival of supplies, but some were sent forward from Myola. After days of heavy fighting, and finally hand-to-hand fighting, the 16th Brigade captured positions overlooking Eora Creek on the night of the 28th and the opposing Japanese force was almost entirely destroyed. The defence of these positions called for great tenacity, and inevitably produced many casualties. The Templeton's Crossing-Eora Creek series of actions lasting nearly two weeks were bitterly contested and the Australian advance marked a critical point in the operations.

As there was still no firm decision about air evacuation from Myola, some of the lightly sick and wounded were started back along the trail to the base areas, while other casualties were sent to the 2/6th M.D.S. at Myola. Great disappointment was felt at Myola at the repeated delays in establishing an air-shuttle between Myola and Moresby. Success in bringing in and out a small plane did not ensure the safety of landing a larger aircraft, and in particular, taking it off again. Perhaps the over-

worked and over-crowded medical centre at Myola did not always realise that delay did not mean infirmity of purpose.

The brigade now moved on and set up headquarters south of Alola: the Japanese were quiet, and there were for the time being no casualties. At Alola Hobson inspected the dropping-ground with Brigadier J. E. Lloyd, commanding the 16th Brigade, and found it unsuitable: there would surely be heavy losses from air-dropping, which was serious, as rations and supplies were scarce.

Diet of forward troops and patrols varied considerably. The standard emergency ration was satisfactory when it could be obtained, and was much better when cooked, but this was not often possible, especially when the troops were in close contact with the enemy. Most of the men wanted carbohydrates; dried fruits, milk powder, and chocolate were in demand during periods when rations had been scanty. The basic tinned beef and biscuits were sustaining but monotonous. Medical officers commented on the need for more salt as well as concentrated carbohydrate when there was a call for increased exertion.

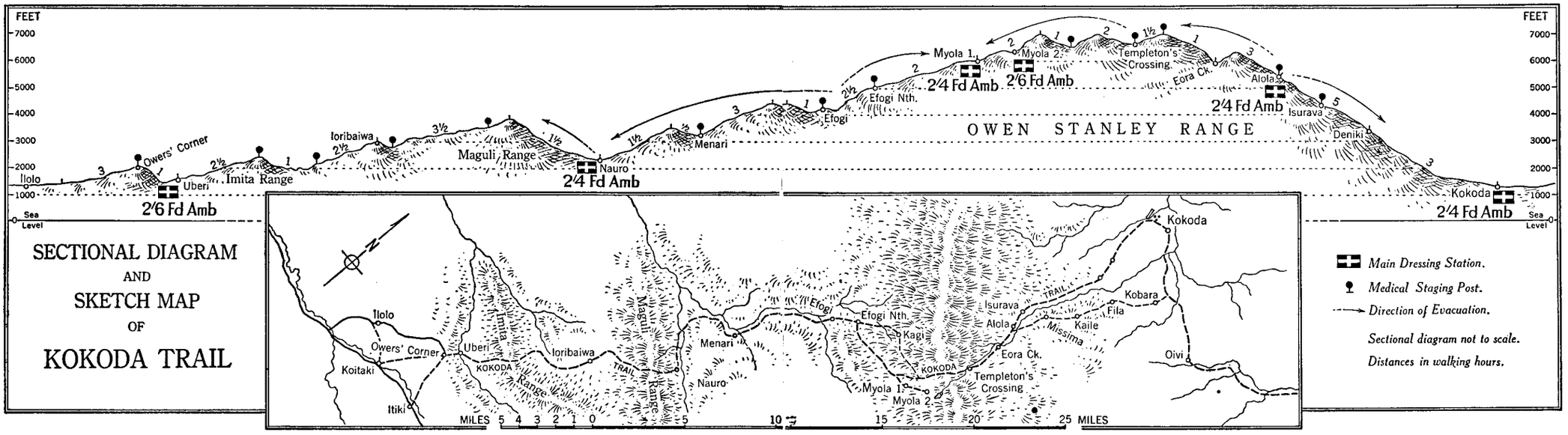
Vasey relieved Allen in command of the 7th Division on the 29th: his headquarters were now in the Myola area, which was being used with success as a dropping ground for supplies. Air-dropping of medical equipment and supplies was found a great improvement in spite of losses, though the percentage of recovery at Myola was not satisfactory; a loss percentage of 80 was not uncommon. The 2/4th Ambulance detachments had found that when ground parties carrying full individual loads of material were divided, they tended to be strung out along the trail, and thus more difficult to keep under unified control.

Before the end of October the 16th Brigade made successful assaults on the Japanese flanks, and on the 30th captured Alola, north of Eora Creek, and were pressing the straggling enemy.

On the afternoon of the 31st the 2/4th M.D.S. at Myola 1 was closed, thus freeing the staff for onward movement, and leaving the 2/6th Ambulance at Myola 2 to undertake the medical and surgical care of casualties from coming actions. McDonald and a party of twenty-one O.Rs. moved on to Alola.

Some medical supplies had now arrived at Myola, and the ambulance was able to send some to the forward posts. The number of patients at Myola 2 had increased rapidly, and as the single M.D.S. was responsible for holding them, with the exception of the men able to begin walking back, the task was great. On 1st November there were 438 men in hospital there, 212 were battle casualties and 226 sick. By midnight all necessary surgery had been performed at Myola 2 but, although this aspect of the immediate situation was under control, medical supplies were grossly inadequate, and there were no reserve stocks of most of the essential items. To relieve the strain the 2/4th Field Ambulance set up a small M.D.S. at Alola, to take sick left by the battalions as they moved through. Love was sent on with a small party to establish a medical post at Isurava rest house. The medical officers found it difficult to provide shelter for the sick. Tents were scarce, and were seldom used complete, usually tent flies only, with gas capes to keep off the fine spray of water; most of the patients were placed under their own ground-sheets.

The military position was changing rapidly. Two brigades, the 25th and the 16th, were at the point of parting. From Alola two tracks led on,



one through Isurava and Deniki to Kokoda, the other a rough track through Abuari, Missima, Fila and Kobara to meet the Kokoda-Oivi road halfway. The 25th Brigade took the track to Kokoda, and the 16th Brigade went towards Oivi. On 1st November Isurava and Deniki were occupied. The following day the 2/31st Battalion, thankful to leave the rain-soaked forest, entered Kokoda unopposed, and with due ceremony hoisted the Australian flag there on the 3rd.

The establishment of sure air contact with the headquarters of New Guinea Force completely altered the aspect of operations, and in particular the outlook of the medical services. Hobson's unit gave medical support to the 16th Brigade along the rough Abuari-Missima track to Oivi, and as many as could be spared set up the M.D.S. at Kokoda.

Captain H. B. Gatenby, a surgeon of the 2/2nd C.C.S. at Koitaki, had been flown in to Myola, and now came on foot with Vickery and party. The 2/4th Ambulance had six officers and forty-nine O.Rs. in the area, and on the 3rd, leaving a small aid post staff at Alola, all set out for Deniki, taking forty-four walking sick who were thus being sent forward to Kokoda. At Deniki the native gardens were helpful as a supply of fresh vegetables, and huts were available for accommodation.

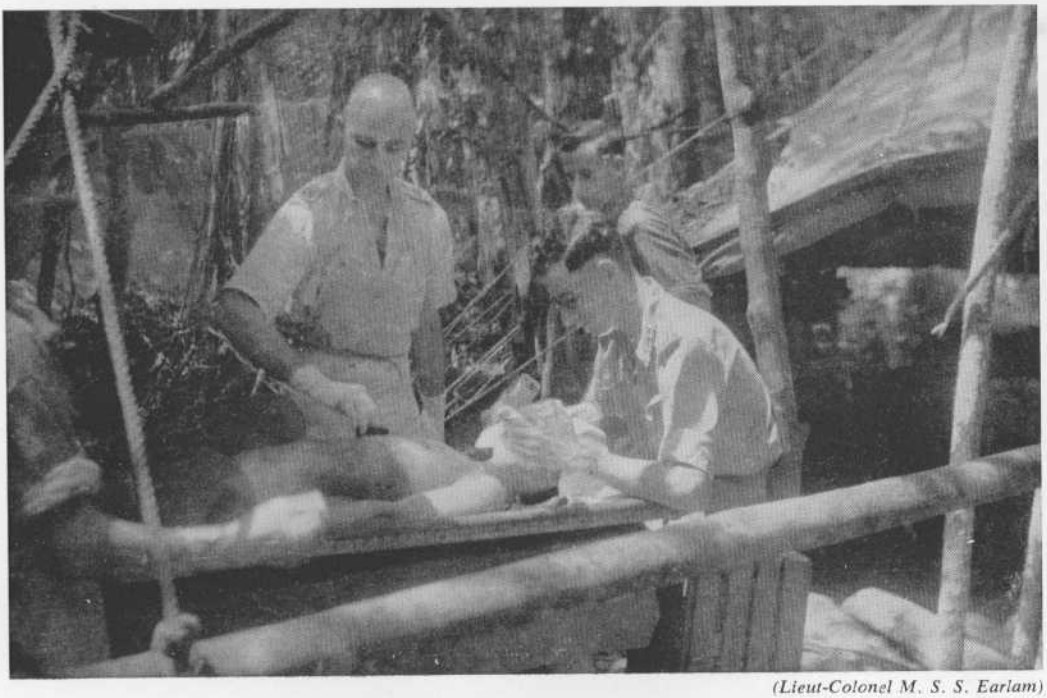
The following midday this medical party with forty-five native carriers arrived at Kokoda, and were taken by Major M. S. Alexander, D.A.D.M.S., to the site selected for the M.D.S. The settlement and Government station at Kokoda had suffered from air attacks, and were largely burnt out, but the natural beauties of the position on the edge of the plantation were striking. Here there was little cover for the sick, who, owing to the shortage of staff, often had to make their own shelters from ground-sheets. Planes were landing on the Kokoda airstrip, promising relief from the stringency of medical supplies. At Kokoda fresh bread, margarine, butter and jam were flown in, an incredible luxury after biscuits and bully beef for some six weeks. It was evident that the establishment at Myola was committed to a long task, leaving only one field ambulance, the 2/4th, forward to serve the two infantry brigades. In view of this position the 14th Field Ambulance was called on again for assistance.

On 27th October Earlam had been asked to prepare a light section of his 14th Field Ambulance to fly to Kokoda after its capture, with the specific object of providing a surgical service during the operations forward of Kokoda. The size of the section was increased some days after to provide two detachments, the first to be of twenty-five, with equipment weighing 10,000 pounds. To the second and smaller detachment were then added dental personnel and full equipment. Delays occurred owing to difficulties in priority and changes in plan, and in the beginning of November the expected date of arrival of the detachment had not yet been fixed. There was no corps field ambulance to be brought forward, and the 3rd and 14th Ambulances were unable to do more; the 3rd was fully engaged in work in the base area, and the 14th still had some of its members on the ranges, and sufficient key personnel were retained in the base area in case the M.D.S. at Bomana should have to be re-opened. McLaren at Nauro was



(Lent by Colonel A. F. Hobson)

The 2/4th Field Ambulance M.D.S. after the bombing attack.



(Lieut-Colonel M. S. S. Earlam)

Major T. H. Ackland, surgeon, and Captain A. R. Wakefield, anaesthetist, doing surgery at Soputa.



Casualties leaving loading point south of Sananda for the M.D.S. at Soputa in a converted car. This car was captured by the Japanese at Singapore and recaptured by Australians at Gona.

(Australian War Memorial)



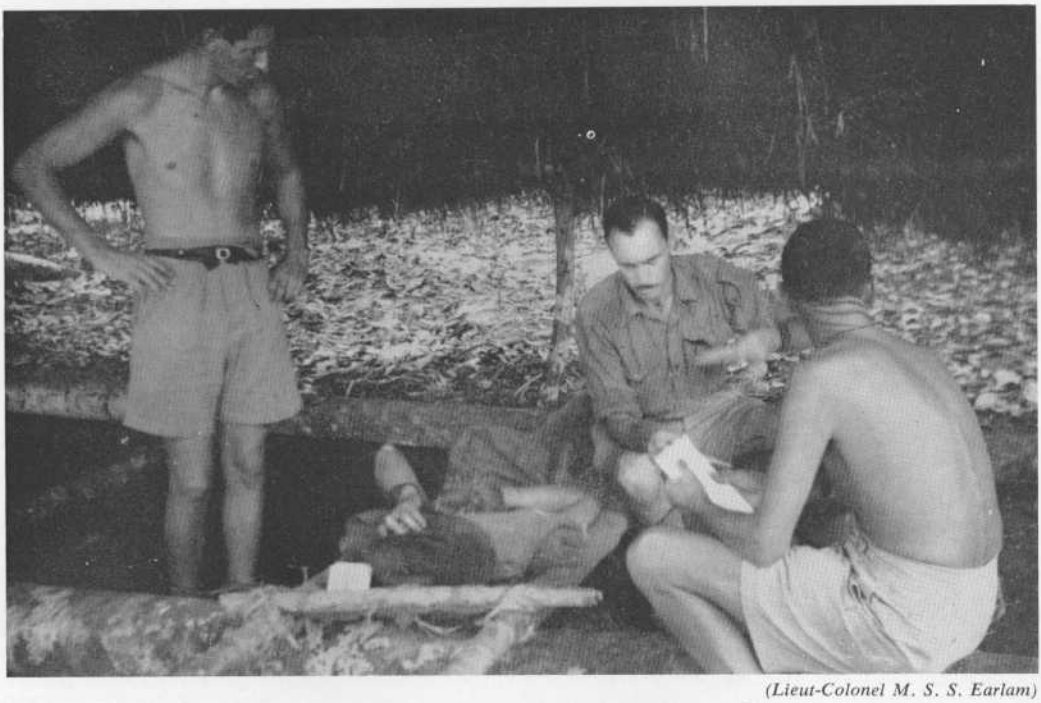
(Australian War Memorial)

Casualties receiving treatment at Gona.



(Australian War Memorial)

Wounded at Gona receive treatment before being taken to the dressing station.



(Lieut-Colonel M. S. S. Earlam)

Captain W. W. McLaren at the staging post near Gona.



(Australian War Memorial)

An R.M.O. at Sanananda dresses an arm wound.



(Australian War Memorial)

Evacuation in the Sanananda area.

moved forward, and the 2/4th Field Ambulance with the aid of Gatenby's team was ready to take up the work onward from Kokoda.

Once the airstrip at Kokoda was in regular use the transport of patients to Moresby could be arranged, but as the force advanced, more medical help would be needed in the Oivi-Gorari section, where the Japanese were expected to put up a strong defence before the Kumusi River. The main road from Kokoda to the river was quite good, though there were numerous water crossings to be negotiated, and parts of the track through Oivi and Gorari were steep. The enemy brought up fresh troops from the coast, and were holding on to these areas tenaciously.

OIVI-GORARI ACTIONS

The 2/1st Battalion was sent from Kobara, along the track from Kokoda, on the 3rd; the 2/2nd Battalion then took a parallel track to the south, and on high ground near Oivi heavy fighting developed. The 2/2nd and 2/3rd Battalions dug in facing a strong enemy position, and next day repulsed a heavy attack, though at the cost of fifty Australians killed or wounded. On the 5th, the 2/1st reached a junction on the south track leading north to Gorari, and two days later Vasey sent the whole 25th Brigade round the southern flank to cut the Japanese rear line at Ilimo while the 16th Brigade kept up pressure at Oivi. The 2/1st Battalion by cutting the track from Gorari to Ilimo trapped the Japanese, who, failing to break through, abandoned the positions at Oivi. This bold action dispersed the remainder of the enemy force, which suffered very heavy losses, and was pursued by the 25th Brigade. Their disbanded forces fled along the Kumusi River under air attack, thus giving Vasey's force control over the Wairopi River crossing, for further onward movement. The struggle for the Owen Stanley Range and for the Moresby base was over, but in the four months of action the four brigades engaged had lost 625 killed and 1,055 wounded.

CASUALTIES AND SURGICAL WORK

The actions which forced the Japanese back over the Kumusi River were fierce and costly. For a fortnight the toll of Australian casualties was heavy, from the fighting at Templeton's Crossing and Eora Creek, and early in November from the attack on Oivi. The Japanese mortars at Templeton's Crossing caused a number of severe wounds, and on the high ground at Eora Creek the 2/3rd Battalion suffered heavily: there were seventeen stretcher cases from this action. Carries from the forward position to the rear R.A.P. were most arduous, some were even up to fourteen hours, and the bearers were often under fire. The patients also showed great fortitude; most of the stretcher patients were taken forward to Kokoda, and those able to walk returned along the trail to the roadhead. By the 11th November a total of 111 patients had been evacuated by air from Kokoda.

The patrolling and fighting at Oivi produced about fifty casualties in the 2/3rd Battalion. Joseph, relieving Wilkinson, who was ill, saw num-

bers of patients with wounds of the chest and abdomen and with compound fractures. Extemporised splints cut from bush timber were used, and the patients were carried to the R.A.P. in single-pole blanket stretchers, so narrow was the track.

ADVANCE TO WAIROPI

During the night of the 12th-13th the fleeing Japanese troops crossed the Kumusi River; a small party pursued the course of the river north and later reached its mouth, and many lost their lives in trying to cross the wide swift-flowing river in boats and rafts. There was nothing now to hinder the dropping of bridge-building equipment from the air, and the work proceeded rapidly.

Three planes reached Kokoda on the 15th, with four medical officers and thirty-four O.Rs. and equipment; this was the detachment from the 14th Field Ambulance, a welcome reinforcement to the medical services, though no fresh solution of the problem of Myola had been reached.

On the 13th the engineers began to throw a wire rope across the river, and next day two flying-foxes were working, and by the 16th a footbridge had been placed across the flooded stream, and the 25th Brigade was on the eastern side of the river and was advancing towards Gona on the plains below. The next day the headquarters of the 7th Division and the 16th Brigade had also crossed the river, and were moving on another prong of the attack towards Sanananda. On this day also an 800-foot landing strip was ready for use on the eastern side of Wairopi.[1]

In September a battalion of the 126th United States Regiment began a difficult advance from Moresby along the Rigo track to Jaure and thence to Bofu on the foothills of the Owen Stanley Range. The main body of this battalion remained here for the time being, and a detachment went on, and on 16th November joined the 7th Australian Division near Wairopi. Remaining forces in Moresby were flown to Wanigela, and thence moved to Pongani.

SUPPLIES DURING THE ADVANCE

Experience showed that some of the standard field ambulance equipment was not indispensable in an atypical action such as that on the Owen Stanley Range, but certain items such as the ordnance equipment were necessary at medical posts. Unless this could be dropped the problem of hand carriage over the trail was raised at once. Further, it was unreasonable to expect that native carriers could be used as a two-way type of transport, bearing patients and supplies on alternate trips. Norris in his outstanding work as A.D.M.S. in this campaign set himself as free as possible to move up and down the track, and Alexander, his D.A.D.M.S., likewise kept in close touch with those units and posts in particular whose work was daily affected by tactical changes and other local factors. This maintenance of contact kept the needs of the medical service up-to-date, even though they often could not be satisfied. The moral effect of this

[1] Australian casualties for Imita to Wairopi 26th Sept-13th Nov: killed in action 16 officers, 273 other ranks; wounded in action 29 officers, 521 other ranks.

practical interest was worth much more. In addition, it was found helpful to have a senior medical officer attached to the brigade staff during movement, so that advice could be obtained and the requirements of the forward areas be met. Men, equipment and medical supplies had to be pooled, and such a pool varied in size according to the troops involved, and the number of axes along which troops were moving. Distances were of necessity reckoned in terms not of miles but days. The recovery of material dropped from the air depended on many factors such as weather and the geographical features of the area. The native carriers performed the work of recovery with natural skill, but they were hampered if the parcels were not distinctively marked, as with colours, or streamers of bandages or hessian. At its best air-dropping achieved a remarkable speed and accuracy, but there were occasions when losses were heavy. Either parcels could not be located, or if located could not be retrieved, or when recovered were poorly packed so that loss from breakage or dispersal was excessive. The urgent need for review of the war equipment tables of field medical units merged from this campaign.

The average proportion of medical supplies recovered was not better than 50 per cent; therefore landing was a much more economical procedure than dropping, subject of course to the possibility of landing within reasonable distance of the forward post or area concerned. Fluids did not survive dropping well. Methylated spirit, which was both useful and scarce, suffered heavy losses, though containers only three-quarters full sometimes survived: other liquids, and oily substances did not drop well, though anaesthetics were successfully dropped on occasion. Tables were drawn up for the division to indicate the periodic maintenance requirements of R.M.Os., M.D.Ss., and surgical teams. Such tables were included in a report by Hobson on the New Guinea campaign from August to December 1942. The nature of the standard medical staging post may be clearly gathered from the following list, setting out the men and material required:

Details of minimum portable equipment and personnel to establish:

A Standard Medical Staging Post.

Personnel: 1 medical officer
6 O.Rs., to include one trained nursing orderly, and one N.C.O., the four others to be able to function as one cook, one clerk and two general duties.

Ordnance Equipment:

Tents complete, 1 (Poles not required in timbered country. Fly or tent used separately were found to be unsatisfactory in wet weather.)
Axes, felling, 1
Shovels, G.S., 1
Picks, 1
Sheets, ground, 12
Blankets, G.S., 24
Kettles, camp oval, 3 (or kerosene tins)
(It was found that kerosene tins were more portable and had larger holding capacity—cooks verify this.)
Ladles, cooks, 1 (can be improvised)

Plates or basins, soup, 12
(Basins, soup, are preferable—plates not suitable for liquids or mashes.)
Spoons, dessert, 12
Pannikins, tin, 12
(Knives and forks not used during campaign—were found to be unnecessary for type of food issued.)
Towels, hand, 6
Lamps, hurricane, 1
Stoves, oil, wickless (Primus), 1
Kerosene, gallons 4 per week
Buckets, water canvas, 3
Flags, directing pendants, 1
Razor, safety, 1 (spare blades as required)
Torch, hand electric, 1 (with spare batteries).
(12 natives are required to carry these stores.)

Many practical details relating to the exact form of medical supplies and the methods of packing were also given in this report. One point of importance was that unless natives were available for carrying water and supplies, such a post should be sited near a supply dump and near water. Six to ten native carriers could be usefully employed about the post. Other non-medical posts, purely for refreshment along the way, were established with advantage. Good liaison between the S.M.O. brigade group and the R.M.Os. was essential, so that their indent of requirements could be consolidated and signalled regularly to the M.D.S. The value of the work of the signal corps was outstanding in regard to the important matters of supply and evacuation.

WORK OF R.M.OS.

Captain A. E. McGuinness, R.M.O. of the 2/2nd Australian Infantry Battalion, remarked on the difficulty in recovering and removing wounded in jungle country, and pointed out the need for adequate doses of morphine to be given at the company R.A.P., since the majority were recovered at night. Means for supplying cover, heat and light had to be provided; these requirements included two stretchers and a minimum reserve of twenty blankets. It will be seen that in the case of rapid movement, both native carriers and R.A.P. staff may be required to carry equipment. McGuinness felt that a transfusion set with enough plasma for one patient, with further plasma available should the need arise would be of great value, as the A.D.S. was often some distance away. The "medical companion" of the R.M.O. was found rather cumbersome in mountainous country; it was suggested that sub-division into two parts would be an advantage.

Several medical officers had by this time commented on the factor of age in soldiering in the difficult parts of New Guinea. The upper limit was generally placed at thirty-five, with the ideal age twenty to thirty years. Stability of temperament was of course important too: many men admitted that the knowledge of the possible proximity of an unseen enemy caused a constant feeling of strain. Though described in different terms by different men in various places, this sense of being hemmed in by some

degree of danger was a reality. The siting of an R.A.P. in a secure place added considerably to the men's feeling of safety if sick or injured. Nervous disorders were on the whole uncommon. This was a tribute to the spirit and discipline of the men and their leaders. Further, it is a special tribute to the R.M.Os., who used their battle experience with firmness and understanding. This remarkable campaign must be viewed in the light of all the relevant physical and mental factors. In describing these, Joseph spoke of:

> The intense jungle, inducing feelings of claustrophobia, its intolerable quietness rent by eerie sounds, the crashing of enormous rotting trees, the narrow tortuous tracks, the knee-deep mud with its vice-like grip, and the torrential tropical rains. Into this awe-inspiring scene with its oppressive heat by day and bitter cold by night place the infantryman clad in jungle greens, the only clothes he possesses, assail him with dysentery, malaria and mite bites which ceaselessly itch.

In addition there were the factors of dietary insufficiency, the fatigue of a rapid advance, and the fear of ambush, which could soon lower morale.

Rations were very monotonous on the whole: men tired of bully beef and biscuits, though these were convenient to handle. Milk and dried fruit with rice were found much more appetising, and dehydrated potatoes and vegetables were also a success when available. Most of the troops on the trail from Uberi to Wairopi felt the constant urge of hunger. Increased intake of salt was essential: many men were found to lose abdominal discomfort and cramps in their limbs after taking salt and resting. In the 2/1st Battalion the R.M.O., Captain J. F. Connell, instructed the men to suck at least two tablets per day.

The ability of wounded men to walk to medical posts was a feature of the campaign; even admitting that only the most seriously wounded could be carried, it was noted that men with wounds of the feet, arms, shoulders, and minor wounds of thigh and head were usually able to walk. Sucking wounds of the chest were relatively common in the experience of McGuinness. Other R.M.Os. saw few of these injuries, but it is admitted that numbers of these men must have failed to reach help. The same was true of abdominal wounds. The R.M.O. and his staff had to walk as his unit moved; while doing all they could to feed, rest and restore the less severely wounded, they still had to drive them on however weary, if able to walk, and each night had to hold such men as were unable to be sent on and care for them as best they could.

Fatigue. Connell pointed out a number of important factors in producing fatigue and strain on the men fighting on the Owen Stanley Range. During the first engagements the 16th Brigade had the help of a large body of native carriers, and some air transport, and could draw upon native gardens. When the force was pressed back to Ioribaiwa the troops arrived with little equipment, carrying no rations or ammunition, though they were able to use some reserve dumps during the retreat. The tracks progressively deteriorated, until they had become a sea of mud owing to the constant traffic of the opposing forces.

By the time the 16th Brigade began to advance conditions were still worse: the native carriers had "gone bush" and only twenty could be allocated to each battalion. This, combined with restrictions on air-dropping owing to bad weather, increased the personal load carried by each man to some 54 pounds. Connell has summed up the physical difficulties as follows:

> In the considered opinion of many experienced officers who have taken part in other campaigns in all theatres of the war—Middle East, Europe and New Guinea—there was no campaign in which the stamina and endurance of the troops was so overstrained as in the second advance across the Owen Stanley Range between Ioribaiwa and Kokoda. As a result of this, and because of it being essential to keep down the weight carried per man to the minimum, the limit allowed was half a blanket. This, together with a ground-sheet, allied to wet clothing, proved quite inadequate to enable soldiers to spend a comfortable night while campaigning in altitudes varying from 3,000 to 8,000 feet above sea level. In the light of this it is a tribute to the morale and general good condition of the troops.

DISEASE ON THE OWEN STANLEY RANGE

Apart from the casualties of battle, infections were, as usual a significant waster of men. Some of these were endemic to the area, others were brought by the men themselves.

Malaria. The Kokoda Trail began and ended with malaria. The posts within short distances of Koitaki were highly malarious, and the sloping country stretching from Kokoda and Wairopi to the coast was also a breeder of anophelines. After the withdrawal to Ioribaiwa malaria was frequently seen at Ilolo, mostly of relapsing type; A.I.F. units returned from the Middle East then used the supplies of anti-malarials they had brought with them. Without atebrin chemo-prophylaxis was not possible. A survey of the track from Uberi to Deniki did not reveal any malarial vectors, and the high elevations where the climate was moist and cold did not lend themselves to malaria transmission. Therefore, once the lower levels of the trail were passed, the risk of malaria was negligible until Kokoda was reached. Attacks of fever on the higher levels, if due to malaria, were not of primary origin. It will be seen that the routines of malarial prevention, and even the taking of suppressive quinine could safely be allowed to remain in abeyance during this part of the campaign, but a real danger lay in the difficulty of re-establishing these routines when the need once more arose.

The A.D.M.S. of the 7th Division asked that anti-malarial equipment and stores, and an adequate supply of quinine should be sent by air to Kokoda, and advised that 10 grains of quinine daily should be taken by all troops from 10th November, a week after their arrival in the Kokoda area. Unfortunately these stores did not arrive, and by the middle of November the lack of quinine, nets and cream exacted its toll of primary malarial attacks, which became so prevalent that special measures were necessary to deal with these casualties. Exact knowledge was also lacking at the time. The medical units had no slides, stains or microscopes until they reached Soputa, nor the measures necessary for

protection, even had it been possible to apply them. The full price to be paid was not apparent until later, when the risks of malaria on the coastal plains were greatly intensified. Quinine was not only difficult to obtain but also hard to keep, as in ordinary packages it disintegrated in the moist climate. Johnston had queried the wisdom of suspending quinine even on the range, but its suspension had eased supply difficulties: 60,000 tablets per week were required. Actually, supplies were sent to Kokoda on 9th November, and further quantities at frequent intervals: 400,000 tablets were sent in two weeks. The missing consignment was found later on the edge of the Kokoda airstrip: it seems that there was some confusion whether quinine was landed or dropped.

Dysentery. Further experience indicated that not all the clinical diarrhoea encountered on the range was due to dysenteric infection. The monotonous diet, at first chiefly hard biscuit and tinned beef with a high fat content, did not seem always to be digested and absorbed, and some of the diarrhoeal disturbances may have been dietetic. But there were hundreds of men afflicted with true clinical dysentery with passage of blood and mucus, and accompanied by colic and urgent liquid discharges. During three weeks of September some 1,200 casualties passed through the A.D.S. at Ilolo; the majority had dysentery. In the period 9th to 14th September, when the retreat to Ioribaiwa was in progress, over 40 per cent of the sick were suffering from diarrhoea, and as the military population grew the position became worse. Chenhall proposed at this time that deep fly-proof latrines be constructed every 400 yards from Owers' Corner to Uberi, a suggestion which indicates the position as it then existed. Whatever degree of hygiene was attained at the posts, with the construction and policing of fly-proof latrines, there was little or no sanitation practised along the track. Major K. Brennan reported to Fairley, the Director of Medicine, that the "sick men through weakness and exhaustion were unusually careless, and water supplies became a danger to the whole area". Both sanitation and water sterilisation were improved, but the factor of human fallibility remained, until the sending of supplies of sulphaguanidine to forward areas promptly and effectively controlled the disease, and rendered the dejecta relatively harmless. A combination of these preventive factors resulted in a fall of the incidence of diarrhoea to 4 per cent, in spite of incessant traffic along the trail. Further improvement in the general condition of the men was effected in the Ilolo area by setting men in the convalescent camp a hardening exercise, which included carrying medical stores up to Imita Ridge, and cleaning up the track.

The importance or otherwise of infection by flies on the Owen Stanley track cannot readily be estimated in a brief statement, since the prevalence of flies varied with the locality. In the steamy jungle and rain forests of the lower levels fly-breeding was profuse where there was a high concentration of troops. Another possible factor in fly-breeding was the use of transport animals in base areas. In the cold wet high level areas there was probably little risk from insect vectors, and in any case their capacity to carry infection was not worked out. There seems no doubt, however,

that transmission took place by direct hand to hand infection or from food, and by water. Ford reported in October that the organisms causing the disease on the range were mostly of the Flexner type, and the remainder, in a ratio of 1 to 15 only, were Schmitz. Patients reaching the dysentery hospital in the Moresby area arrived in fair condition, even after walking for six to seven days, and cultures seldom revealed dysentery bacilli. The Japanese on their retirement left evidence of dysenteric infection, in their fouling of the ground, for their hygiene was primitive, but fears of an outbreak of Shiga dysentery or still worse, of cholera, proved groundless. There seems no doubt that the timely use of sulphaguanidine, administered at once in the early days or hours of the clinical malady, stopped a damaging and serious epidemic.

Typhus Fever. As was expected, patchy outbreaks of typhus occurred on the trail. As all men with evidence of a possibly serious febrile illness were sent to the base by carrier as soon as possible, the problem was not one of diagnosis or treatment as much as of evacuation. The numbers of typhus infections increased during the latter part of 1942, but these were drawn from a number of areas other than the Owen Stanley Range.

Malnutrition. Ford pointed out that although a frank clinical state of beriberi is not easily produced in less than eighty days, this period may be shortened by exhaustion and infectious disease. Only a few cases of beriberi were observed among men cut off from other groups and on low and poor rations for periods of weeks.

Respiratory infections. It is of interest to note that on the whole very little respiratory disease was observed on the trail. The men were often exposed to fatigue and cold, and were constantly wet through at some of the higher levels but, though often forced to rest or even to try to sleep on wet ground, exposed to mist and rain, they remained free from infections of the respiratory system except in localised outbreaks.

MEDICAL WORK AT KOKODA AND WAIROPI

Three days after the occupation of Kokoda five stretcher patients and eleven others were flown to Moresby, and an encouraging amount of supplies was received. Six battle casualties arrived at the M.D.S. and 93 sick. More tentage was required, as there were torrential falls of rain which hindered air transport on the following day. The climatic conditions were then humid and trying, especially by contrast with the cool of the mountains. On 7th November there were a number of seriously wounded men among the 46 battle casualties admitted, and 173 sick. Weather again prevented inward or outward air traffic.

Next day conditions were better, and more fresh food was available for the 52 battle casualties and 205 sick. Most of the latter were suffering from diarrhoea (probably dysentery) and pyrexia, due either to malaria or scrub typhus. On 12th November Captain M. G. F. Donnan, R.M.O. 2/25th Battalion, was admitted with a gunshot wound of the elbow.

By the time the M.D.S. had been working for a week the staff was accustomed to the alternation of being able to send away patients one day,

but none the next, and to similar fluctuation of stores. There was sometimes actual hardship to the patients, who had to be moved to the airstrip in spite of uncertainty of plane movements. If patients who were only slightly ill appeared likely to recover within ten days or less, they were returned if possible through a reception camp to their own units. The staff of the Kokoda M.D.S. found later that many of these men were not really able to rejoin their units as active members, and the nature of the camp was changed from a transit or reception camp to a convalescent camp under daily medical supervision. A good ward system was now in use, and the surgical and other routines were running smoothly. The A.D.M.S. arranged that the 2/4th Ambulance would follow the divisional headquarters to Oivi when New Guinea Force could arrange relief.

Improvement in the weather made it possible to reduce the bed state of the M.D.S. to a comfortable low level, and when Major L. P. Hiatt arrived with the 14th Field Ambulance detachment from Moresby by air, the numbers had fallen to four battle casualties and 160 sick. Five officers and some sixty-three O.Rs. and thirty-six native carriers of the 2/4th Field Ambulance left Kokoda. Although some 800 pounds of stores were sent on in advance by jeep, the members of the party were very fatigued by the journey over a muddy track in hot humid weather, for all had to carry some unit equipment as well as personal gear.

The 14th Ambulance detachment found that the moving forward of the fighting force made Kokoda a backwater, but it was still an important evacuation centre, for stretcher cases could only be transported by air to Moresby by carrying them to Kokoda along the trail. Fresh admissions were few, and came from neighbouring units, which were rapidly dwindling in size. One perhaps unexpected difficulty was experienced after the force reached Kokoda, the necessity of helping to feed numbers of natives who returned there after the Japanese left. For a time there were 300 whites and 1,300 natives needing food. Some of the transport pilots helped to ease this situation, especially those of the Wirraways, who brought in bread and cigarettes. Later air evacuation, which had been very irregular, was sufficient, and supplies were good. The M.D.S. at Kokoda was kept open until all the patients from Myola had either walked back to Ilolo or been transported via Kokoda to Moresby, and on 20th December this need no longer existed and the dressing station was closed.

On 17th November the 2/4th Field Ambulance party left Gorari, and went on to Wairopi. The medical conditions here verged on the impossible, as the numbers of sick were beyond the powers of the limited staff on hand to cope with them. On the 13th McDonald and Love and accompanying parties had been sent along the Ilimo track to set up posts at sites selected by Norris. The next day McDonald arrived at Wairopi and when Day also arrived they set up a small post just off the track; McDonald and party then moved on. Day was confronted with the danger of his men being injured by stores dropping from planes and had to move to a safer site, and on the 16th had only six O.Rs. to look after over 100

patients while they erected tents. The main party of the ambulance found him on the 17th trying to cope with 120 patients, and before moving on to forward posts this party was able to help with the difficult situation. Norris summoned the main body of the unit to Sangara Mission with all available staff, and leaving Day and Wilkinson with seventeen O.Rs. to care for 200 patients, they set out on a long and arduous march, with their entourage of native carriers straggling out along the track. The ambulance unit reached Sangara on the 19th.

During this journey Hobson's staff found many sick men in the villages along the track, needing care, but there were no carriers to spare, and the best that could be done was to leave quinine and rations with the men and tell them to come on as soon as they were able. The only rations were those remaining from the issue at Wairopi, which were pooled and divided among patients. The staff lived on the products of native gardens until they reached Popondetta. McDonald's party pressed on to Popondetta in advance of the rest of the unit, some of whom remained at Sangara to look after forty men who had collected there. Major S. Elliott-Smith of Angau arranged to send natives back to Wairopi to collect 400 rations, and to provide fruit and vegetables from the gardens for the use of those at the post.

Meanwhile the numbers had risen at Wairopi, where there were 265 sick men, including six battle casualties on the 19th. Most of these men had fever, due to some cause which could not well be determined at once under the existing conditions; many also suffered from dysentery or mild diarrhoea. Day and Wilkinson with seventeen O.Rs. and eight Rabaul natives attached for general duties were able to give reasonable care to the sick. The 20th found the majority of the 2/4th Field Ambulance down on the coastal plains at Popondetta; McDonald's party was sent still farther on, to Soputa, to form a medical post there. The next day the main body of the unit followed to Soputa, and there we may leave them at present while we follow the doings of the 2/6th Field Ambulance left at Myola, and the other posts at Kokoda and Wairopi.

Myola was an important focal point in the ebb and flow of the series of actions on the Owen Stanley Range, and highly significant in the provision of surgical facilities for a force involved in several heavy engagements. Further, it raised the problem of air evacuation so acutely that in this respect it is historically important. Therefore we may briefly recapitulate the history of the medical community shut up in a plateau on a mountain top, and the efforts made to lighten their unique responsibility.

MYOLA

During the first phase of the campaign when the Australian forces began to retire in the face of heavy Japanese pressure the plan of using Myola as a medical and surgical centre and as a convenient dropping place for supplies, led naturally to the exploration of the possibility of a landing ground being developed there. These plans were rapidly dissipated when the Japanese, after a temporary check by the 2/16th Battalion,

threatened to by-pass Myola along the track from Kagi to Efogi. On 2nd September there was then no alternative; Myola was abandoned at least until the tide of battle ebbed back again to Kokoda, but the hope of constructing a landing strip there persisted. When the Australian force pressed on again from Imita, and went through from Efogi and Kagi without opposition, the way was clear once more to Myola. Norris described in his account of this movement how the M.D.S. at Nauro "became out of date, and with the assurance of air evacuation from Myola, further rearward evacuation beyond Efogi north ceased". In earnest of this hope the 2/4th Field Ambulance reduced its forward posts and the M.D.S. at Nauro as far as was safe, and on 16th October established an M.D.S. with a surgeon, Captain Leslie, at Myola 1 until the 2/6th Ambulance should have overcome the difficulties of securing relief and enough carriers for onward transport.

Myola was a flattened area thought to be an old crater or dry lake; it was over 6,000 feet above sea level. There were two good sites for main dressing stations, known as Myola 1 and Myola 2, which were separated by some two hours' travel on foot. A stream flowing from the watershed of the Owen Stanley Range, about 1,000 feet above, skirted Myola 1, and rushed on to feed Eora Creek at Efogi. The climate was reasonably good; the mornings were usually fresh and clear, but later the characteristic banks of cloud appeared, and rain would fall in the afternoon. The nights were cold. Myola 2, some four square miles in extent, lay beyond a spur of the range, and was higher and more level.

The greater part of these two flattened areas was swampy, but around their perimeter were areas of level ground which promised to be suitable for airstrips. From the point of view of planning Myola seemed ideal. Casualties could be transported forward from the posts immediately to the rear, and until Kokoda was taken they could be flown back to the base. An airstrip was quickly completed by the engineers, but a serious difficulty had still to be surmounted, that of securing suitable aircraft for ambulance work in this mountainous area.

On 16th October the 2/33rd Battalion had captured the objectives at Templeton's Crossing and was advancing to Eora Creek. The next day all the 2/4th Ambulance men who were at Uberi moved on with those of the 2/4th and the 2/6th Ambulances who were the division's composite unit at Uberi, and arranging for A.A.S.C. details to carry medical stores, went forward to Myola, where there were over forty battle casualties. The 14th Field Ambulance sent up men to help fill vacancies at Uberi. The advanced divisional headquarters was also at Myola, and Chenhall with five officers and sixty-eight O.Rs. was moving up there to staff an M.D.S. It was then doubtful if evacuation from Myola could be arranged or not. The 2/6th M.D.S. was established at Myola 2 on the 24th. A few days later arrangements were made to send up 700 pounds of fragile items of equipment to Myola, and in response to a request from Alexander more men were also sent. The admissions to the M.D.S. at Uberi were now dwindling, though staging posts were still necessary.

On 1st November Hobson was instructed not to take more battle casualties in the 2/4th M.D.S. and to move on to Alola, which had been captured without opposition two days earlier. Three days later the 2/4th M.D.S. was at Kokoda. This rapid advance caused considerable congestion and difficulty in the 2/6th M.D.S. whose staff had to cope with all the patients which had been held by the 2/4th as well as their own. They had worked very hard; by now all major primary operations had been completed, and they were holding 438 patients, 212 of whom were battle casualties. The unit was desperately short of medical supplies, and had no wool, bandages, or catgut, and was without sulphanilamide and other essential drugs. A small party of walking patients was sent back to Uberi. In this anxious plight Chenhall sent a signal to the consulting surgeon at Land Headquarters and repeated this to the A.D.M.S., 7th Division, and the D.D.M.S., New Guinea Force. This message conveyed strong complaints of non-filling of indents, lack of air evacuation, and the hazards of the surgical situation, which was certainly a worrying one, for at Myola were some 140 patients who would need transport in order to reach hospitals at base. The air evacuation on which so much had been built had not taken place, and even air-dropping of supplies had not been adequate for the great needs of the little medical community marooned at Myola. Chenhall sent calls for help and criticisms which were not couched in terms as temperate as they might have been; unfortunately he was in an isolated position in which he could know little of the difficulties experienced in keeping the forces supplied with necessities. However, the situation, whose urgency was already well known to the responsible administrators, was promptly relieved by the arrival of a plane with stores, and later by the dropping of further material.

Even before Myola came into use as a medical and surgical centre the difficulties attending air transport of sick and wounded were apparent. The elevation of 6,500 feet above sea level was a hazard in itself, and undue risks could not be taken. Under certain weather conditions it was difficult and sometimes impossible to land, and often difficult to take off, for a hill near the take-off point necessitated a rapid gaining of height in a climbing turn. Very few planes were available in Australia suitable for air ambulances, and there were not enough air transports; even fewer aircraft were in any way suited for coming in and out of Myola. A few pilots were optimistic, but the senior air force officers, including the commander of the United States Air Force in New Guinea, would not permit planes in the area to be used for this purpose. Efforts were made to obtain a few suitable planes; three single-engined Stinsons, a tri-motor Ford and a DH-50 were available. A three-engined Stinson commercial aircraft was adapted for ambulance work, but, after reconnaissance, attempts to land were considered unwise. Lieutenant R. E. Notestine, U.S.A.A.F., took in a single-engined plane with stores and took out two patients successfully on each of a number of trips, and after this plane was grounded for repair, made two trips with another Stinson.

On 9th November Brigadier Johnston flew into Myola; as the weather was bad he remained till the next day, and inspected the area. He discussed the position with Chenhall and pointed out that it was expected that some natives would be available for taking stretcher patients as well as supplies to Kokoda. On the previous day a fighter-type aircraft had come down in the neighbouring trees; the pilot, who was not seriously hurt, was later flown back to Moresby for interrogation.

After an interval Mr T. O'Dea, an experienced civilian pilot, was flown into Myola to examine the possibility of bringing in the Ford tri-motor plane, which could lift ten patients. He was delayed by weather, but after walking to Kokoda he flew the Ford in on the 22nd; unfortunately the aircraft was damaged in landing on muddy ground at the extreme end of the runway, and he sustained injuries. The second Stinson also crashed in another area, and it was then hoped that the remaining Stinson and a DH-50 could continue the service to and from Myola. But the next morning the third Stinson crashed on the Myola strip, and all practical attempts to transport patients regularly by air vanished. However, up to 24th November forty-three patients were safely taken by air to the Moresby base, not more than two at a time, and instruments, other essential supplies, and Red Cross comforts were brought in.

Thereafter the situation gradually eased. Medical requirements at Myola lessened, and when it was learned on the 24th that no patients were awaiting air transport at Kokoda, there seemed reasonable hope that those still at Myola would be soon moved on. Groups of walking patients both medical and surgical were sent on to Ilolo; from the 25th to the end of the month forty-two patients were able to make the journey under their own power.

The last of the sick and wounded, together with the remainder of the unit, arrived at Port Moresby just after Christmas. The Myola episode was tense and anxious for all concerned, and in some ways was dogged by misfortune. Nevertheless the 2/6th Field Ambulance did excellent work and showed great tenacity of purpose, so too did Notestine, who made many flights with success, and did much personally as well as technically to help the men isolated on the mountain range. Fortunately, in spite of accidents no one was seriously hurt, and all patients flown out made the journey in safety.

CHAPTER 6

THE BUNA CAMPAIGNS

ONCE the Kumusi River was crossed at Wairopi, and the Japanese forces in that area were defeated it was important that the Australian 16th and 25th Brigades should reduce the Japanese defences on the coastal plains as quickly as possible, before the enemy had opportunity to reinforce the Gona-Sanananda-Buna sector.

On 18th November the advanced headquarters of the 7th Division moved on from Wairopi, leaving the 3rd Battalion as a rearguard to search the Kumusi Valley, and with a party from the 2/4th Field Ambulance, stayed overnight at the Sangara Mission, where there were patients to be cared for. Six of these were unable to travel and were left with two orderlies to look after them while the divisional headquarters moved on to Popondetta. McDonald's party of the field ambulance had gone on to Popondetta where sixty patients were collected. This number swelled rapidly to 100, and a like number were at Jumbora with Captain J. W. Follent and a team.

The urgency of the medical position which thus developed within a few days was due to several important factors. The change from the cold wet mountains to the steamy foothills was trying, but much more exhausting and difficult were the swampy plains of the north Papuan coast stretching inland from the haze of the sea. Only a narrow fringe of sandy higher ground separated the settlements of Gona and Buna from mangrove swamps near the sea and sago palm swamps farther inland, and the wide Girua River fanned out into a marshy delta between the inland approaches to Buna and Sanananda, in itself a formidable obstacle. Gona and Buna, two settlements on an arc of sea roughly bisected by Sanananda Point, were the two focal points of the initial attack. The tracks connecting the more settled areas ran as far as possible on higher ground, but all were muddy and difficult for wheeled transport, and after the frequent downpours of rain were boggy and treacherous. The water table was not far below the surface; this made sanitation difficult.

The contrast between the mountains and these plains as seen from the air was striking. Areas of dense forest alternated with deceptively smooth green patches of swamp, and other stretches of tall kunai grass. The grassed areas were dry and offered good sites for airfields. Twisted tracks led through the kunai, baking hot and airless, and elsewhere dense undergrowth and jungle impeded progress. More important was the prevalence of the vectors of tropical diseases, dengue, scrub typhus, and above all malaria. Already the impact of pyrexial diseases was weakening and thinning the force.

There were four sectors where the Japanese had prepared positions and from which they had to be expelled; Gona and Sanananda, opposed by the Australian 16th and 25th Brigades, and Buna and Cape Endaiadere,

where the American 32nd Division was concentrated. Most of this part of the American force had been flown into the area; only a small force had come overland on foot by the Rigo track over the mountains.

MEDICAL ARRANGEMENTS

Work was proceeding on the airfields under construction at Popondetta and Dobodura, and on 22nd November, the day after the Australian divisional headquarters had moved to Soputa, there were strips in use at Popondetta and Dobodura. At this time the medical force available for care of the assembling troops was slender in the extreme. The two Australian brigades were in contact with the Japanese, and the immediate medical strength amounted to three officers and nineteen O.Rs. Some members of the field ambulances who might have been usefully employed had been left at the base; for example, the Army Service Corps drivers could not be used as drivers, but might have been otherwise useful. Only two field ambulances had been available to the force on the range, the 2/4th and 2/6th, with assisting detachments of the 14th Field Ambulance which was stationed in the upper Moresby area. The 2/6th Field Ambulance was still at Myola, and for the past three months all the ambulance staffs had been working without remission. The 2/4th was nearly exhausted, and Colonel Norris had asked that this unit should be relieved: the medical divisional diarist commented "every time they stopped they were over-taxed with patients, then they would pack up at short notice, dash ahead, collect patients *en route,* set up, and by nightfall, be functioning fully".

The 14th Field Ambulance had the greater part of one company working at Ilolo with small detachments strung out along the Kokoda Trail. When Myola was evacuated these parts of the unit were concentrated in Moresby, and did not cross over to the northern coastal plains. The Kokoda detachments rejoined the parent body on foot; some of them were later flown from Moresby to Popondetta, the equivalent of a company reaching there on the 23rd, and the remainder of the unit going forward as air transport became available.

As soon as the divisional headquarters was established at Soputa Hobson set up an M.D.S. there, leaving Follent's team to run an A.D.S. at Popondetta and Captain R. H. L. Dunn to maintain another at Jumbora west of Soputa. Each of these stations held at least 100 sick, for pyrexial diseases were prevalent and left an aftermath of debility in the already tired men. The staffs at these posts had difficulty in coping with the patients who were pouring in. The M.D.S. was holding 300 patients on the night of the 22nd, including two Americans. Additional strain was to be expected from this source too, as the American regiment which had just arrived had as yet no functioning medical establishments.

It was at this stage that Major E. H. Hipsley arrived by air at Popondetta with a party from the 14th Field Ambulance, and set up a plane loading post to hold up to 200 men: casualties started to arrive practically as Hipsley landed. Natives cleared areas for tents and made tracks, while

the A.A.M.C. men pitched tents. Many casualties arrived throughout the day, and though some were sent on by plane many remained through the night, often on parachutes in jeeps, or lying in the open, as there was an acute shortage of stretchers. Late next day fifty stretcher cases were brought in from Soputa by a force of 300 native carriers with eighty walking casualties, but only a few could be sent away. The commander of the Popondetta station asked the post to move under cover, and most of the next day was occupied by this movement, with patients steadily arriving throughout. Some patients were housed in a local building. The work carried out at the plane post was an indication of the numbers of sick, but to these were also being added battle casualties.

Contact with the enemy had been made promptly by the two Australian brigades on their arrival in the coastal area. The 25th Brigade pressed on from Wairopi to the Amboga crossing and thence to Jumbora, and on 19th November encountered Japanese forces a little south of Gona. The 2/31st Battalion made some advance into the Gona area, but later withdrew after sustaining many casualties. Meanwhile, the 16th Brigade advanced towards Soputa, but after encountering the enemy near there, was held up by strong defences and halted across the Sanananda track. Personnel for new medical posts were placed with the rear headquarters of the 25th Brigade. The men of the 16th and 25th Brigades were very tired, and a disconcerting wave of malaria was sweeping over the force. On the 22nd a further determined attack was launched on Gona, but again the Australians sustained heavy losses, both on this day and on the next when the 2/25th Battalion attacked. With the help of the 3rd Battalion, and field guns brought in by air, some advance was made on the 25th, but the force later withdrew. The 25th Brigade now had only 736 men, and was overdue for relief, but this was expected shortly.

FORWARD SURGICAL WORK

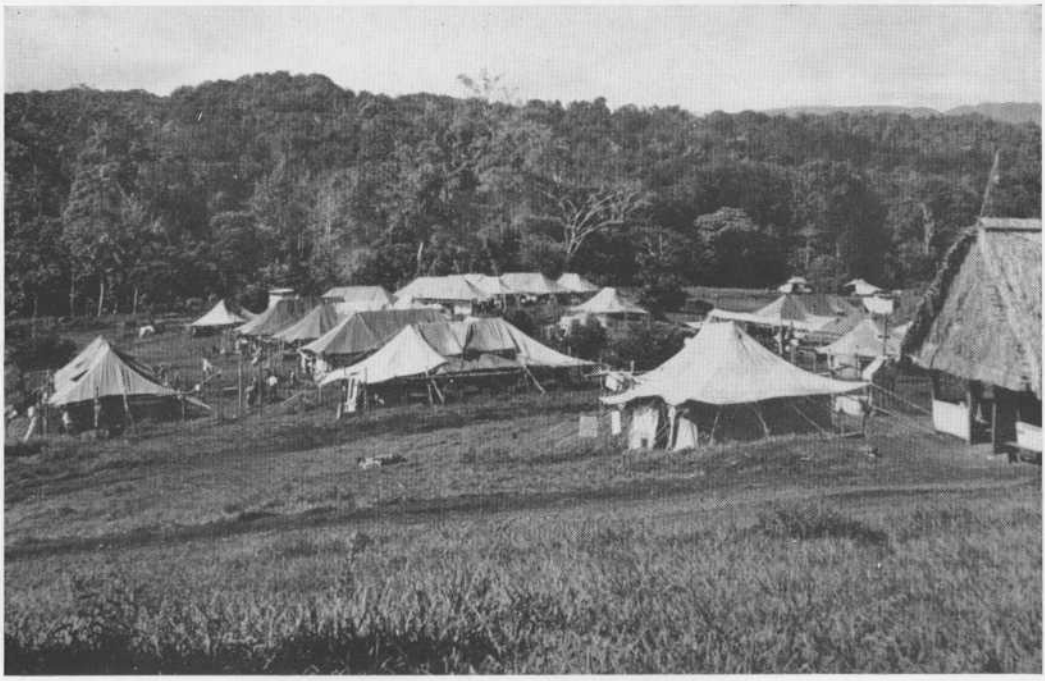
These actions made it imperative to have adequate surgical assistance in the forward area. The position was in some ways much easier than it had been with regard to evacuation to base hospitals, for there was now good plane transport coming in to the airfields, but this was conditional on weather and the needs for other purposes. Also a very fluid organisation was needed at the airstrip A.D.S. which might be called upon to handle, and if necessary to hold, a large number of men, many of whom were seriously ill or who had been severely wounded. Even while the rear elements of the force were making their way down from Wairopi, a call had come on the 20th for surgical assistance for seventeen battle casualties at Sangara Mission. Fortunately an old utility truck found in a Japanese workshop had been discovered and reconditioned, and this enabled Gatenby and a team to be despatched without delay.

As we know, a party had been sent on to Soputa as soon as possible to set up an M.D.S., and when the main party of the 2/4th Field Ambulance arrived they found McDonald in a post holding sixty patients, mostly battle casualties, in a pleasant clearing on the west bank of the Girua



(Lieut-Colonel M. S. S. Earlam)

Plane evacuation from Popondetta.



(A.A.N.S.)

The 47th Camp Hospital, Koitaki.



(Colonel F. L. Wall)

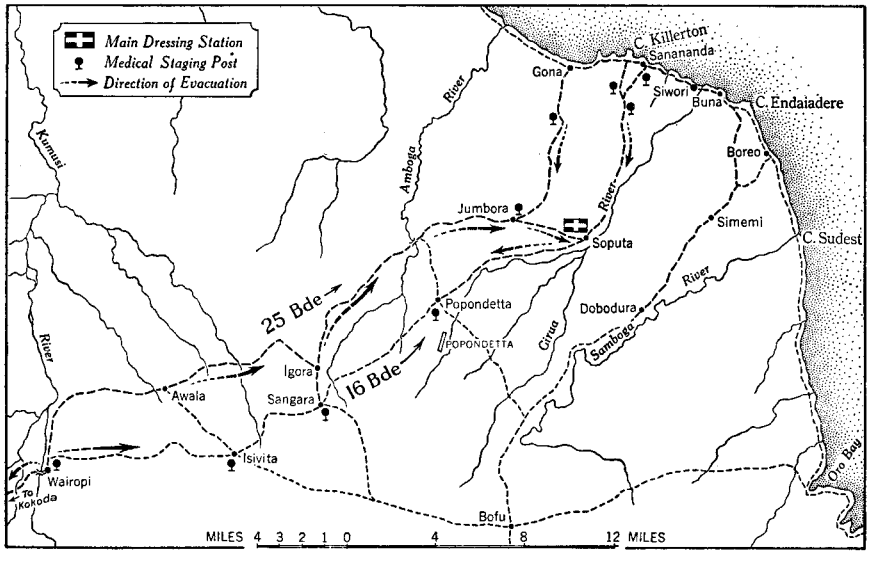
Kalobi Creek, Milne Bay normal.



(Colonel F. L. Wall)

Kalobi Creek in flood. The first site of the 110th C.C.S. was less than 100 yards downstream from here.

River. Equipment and cover were short, and no further supplies arrived for another twenty-four hours, during which the numbers mounted disconcertingly. A surgical team began work from early morning, Hobson and Vickery doing the surgery, and all urgent cases had received attention by dawn on the following day. Natives under the direction of Angau constructed a large hut and began to build another theatre, so that two theatres could work simultaneously. On the 23rd, casualties continued to pour in, and the more acute conditions were dealt with, though the



surgeons were in desperate need of supplies until five packages were dropped at Soputa. The United States Task Force hospital was not yet functioning, but medical officers of the 126th Combat Clearing Station offered their services, and some supplies such as ether, dressings and pentothal. This assistance was most welcome and valuable, and enabled the work to be carried out with care and expedition. By dusk on the 23rd, 130 wounded and 229 sick were in the dressing station. Members of the unit had by this time given medical and surgical care to some 750 to 800 men in their posts from Wairopi to Soputa. The surgical teams were again working all the following day. The divisional headquarters arranged for twenty-five natives to be employed for general duties under Warrant Officer K. Williams.

As Hipsley's party was now running the Popondetta plane post Hobson was able to recall Follent and his six O.Rs. to the M.D.S., and the following day an additional medical officer arrived. On the 26th Major T. H. Ackland, Captain A. R. Wakefield and three O.Rs. from the 5th C.C.S. reached Soputa, and some O.Rs. from the 2/6th Field Ambulance also arrived. These accessions gave great relief, and with Ackland's team

in charge of the surgery, Gatenby and his surgical team could be given much needed rest. Follent was sent back to Popondetta to ease the strain at the post there. Evacuation by jeep was now going on day and night: these invaluable little vehicles carried stores and ammunition from Popondetta airstrip to forward areas, and took patients on the return journey. From all sources and various units the 2/4th Field Ambulance could call on the services of twelve officers and eighty-eight O.Rs., but in times of stress an alternative unit was badly needed. This depleted strength is more pointed when it is realised that the original War Establishment of a field ambulance included twelve officers, 225 O.Rs., including one officer with 56 O.Rs. A.A.S.C. personnel. It may be remarked here that the M.D.S. in jungle fighting was a much more attenuated organisation than that well-equipped and staffed set-up which rightly often constitutes the pride of a field ambulance.

AIR ATTACK ON 2/4TH M.D.S.

A further attack on the Japanese was planned, and on the 27th the A.D.M.S. held a conference at the Soputa M.D.S. to discuss methods of dealing with the situation. Hardly had this concluded when enemy planes appeared and bombed and machine-gunned the 2/4th M.D.S., the 7th Divisional Headquarters and the 126th United States Combat Clearing Station. The raid lasted ten minutes and did great damage in the M.D.S. where of necessity the tents were not dispersed or camouflaged. Twenty-two men were found to be dead, including Majors Vickery and McDonald and five other members of the unit, and more than fifty were wounded. An eye witness pointed out that the only real shelter was a narrow ditch on one side of the road and, across the road, the sloping banks of the Girua River. The attack was so sudden that no patients save those moving about had any warning.

> It was a scene of utter devastation; tents holed, huts keeling over, the quartermaster's-cum-dispensary store burning. Dead and wounded included patients, members of the field ambulance, natives and visitors to the hospital. In a few minutes a busy hospital was transformed into a miniature battlefield.

The conduct of staff and patients was irreproachable. The M.D.S. was close to the track, and within 100 yards of the divisional headquarters, but the Geneva cross and Australian flag were clearly displayed, and one ground emblem was placed at the end of the unit lines. The American combat clearing station had removed its red cross on the previous day since planes were dropping stores on it. It seems certain that the Geneva emblems were plainly visible since planes had carried out a low-level reconnaissance a few days earlier.

On the following day, the 28th, the M.D.S. was moved back along the track a quarter of a mile, and re-sited in dense jungle. Natives cleared tracks through the area, and by the 29th the whole establishment and the patients had been moved. At the time of the raid there were about 200 patients in the M.D.S. Most of these were sent to Popondetta; even

so, the staff had to cope with fresh patients, as well as the burial of the dead and the clearance of wreckage while evacuation was going on. Gatenby's surgical team was sent to the post held by Mutton at Jumbora, and extra O.Rs. went also to Dunn's post at a forward dump. Brigadier Johnston visited the unit in its new location with Colonel Norris, and was able to see the M.D.S. admit twenty-two wounded and seventy-six sick on the day after the move. The next day was described as "routine", eighty-seven were admitted wounded and seventy-five sent on to Moresby, ninety-six sick came in and ninety-two went out, while Ackland's surgical team worked all day and far into the night. The planes came in good numbers after this, and the post was soon cleared of wounded.

On the 28th the 21st Brigade was flown from Moresby to reinforce the 25th Brigade, and by the 30th was heavily engaged. During the first week of December Vasey made strong attacks on the Japanese strongholds. The 30th Brigade now came under the 7th Divisional Command and the 2/16th and 2/27th Battalions attacked Gona. The 25th and 21st Brigades, both much depleted, were now before Gona, while the 39th and 2/14th Battalions moved eastward towards Sanananda.

Disposition of United States Force

The United States front faced the Japanese at Buna and in the region of Cape Endaiadere. Only a detachment of a battalion group of the 126th United States Regiment had been associated with the Australian forces, and then only since its path crossed that of the 7th Division at Wairopi. The remainder of the group halted at Bofu, before taking up battle stations, and the remainder of the regiment, with the headquarters of the 32nd United States Division with the 128th United States Regiment was flown over from Moresby to Wanigela and to Pongani and Abel's Field where airfields had been constructed. The move also involved transport by small ships to Pongani. By the middle of November the division began to move north, and the 126th Regiment with its III Battalion was moved to Soputa, under command of the 7th Australian Division. The remainder of the division was reorganised into two groups, Warren Force on the right flank of the Buna position and Urbana Force on the left. Contact with the Japanese was made on 20th November.

Urbana Force began attacks on Buna on the 22nd, but it was early in December before these movements attained any degree of force. On 5th December Urbana Force advanced on Buna village and Warren Force also launched a large-scale attack.

On the 4th the 126th Combat Clearing Station had moved to Dobodura, and the 107th Task Force Hospital was moving back to take over its site. Next day when the American forces were heavily engaged, the admission of American casualties to the Australian M.D.S. at Soputa increased the work considerably. The bed state at Soputa showed on the 5th the following admissions: Australians, battle casualties 2, sick 104; Americans, battle casualties 54, sick 28. The strain was eased on the next day when the Task Force hospital was able to take casualties.

MEDICAL CONDITIONS

During the afternoon of the 6th twenty-five enemy bombers, escorted by fighters, attacked the Popondetta post by pattern bombing. Fortunately the bombs fell wide and there was only one casualty, a native, who was killed. No patients had been flown back to Moresby for forty-eight hours owing to the obstruction of the airstrip by an aircraft with a collapsed undercarriage. As there were over 400 patients at the airstrip post and the post was only several hundred yards from the target, the damaged plane, it was fortunate that more damage was not done. The 25th Brigade was withdrawn the following day, and the 21st, again attacking Gona, was able to capture it from the Japanese.

This week of pressure coincided with some changes in the Australian medical arrangements. Malaria was still reducing the efficiency of the medical services: so many men were running temperatures, owing to partly suppressed malaria, that it was at times difficult to supply men for general duties. No accurate survey of malaria could be made at that time, but inspection of the battalion medical officers' aid posts showed a very high incidence of pyrexia among the troops. Hobson was obliged to give his own A.A.M.C. men courses of treatment so as to keep them on duty and thus cope with the work. Though men with malaria were not supposed to be sent back to the base area unless their condition warranted it, those ill enough to be evacuated from the fighting line were passed straight through the M.D.S. at Soputa to Popondetta and thence to Moresby, because simply, they could not be held. The addition of a forward pathological section made diagnosis conclusive, and the issue of fresh clothing for the first time since leaving Moresby gave the men added physical comfort, even though torrential rain reduced the area to a mass of mud.

New Guinea Force took over the administration of the Popondetta area, and Brigadier H. C. Disher, who had arrived at Moresby on 28th November, took charge of the medical arrangements of the force. The relief of the 2/4th Field Ambulance began early in December and McLaren moved with a party to Jumbora, while other men from the 14th Field Ambulance prepared to take over Jumbora and Dunn's post in the forward area. An additional help to the work at Soputa was obtained by the acquisition of a motor ambulance: this was a captured converted car which could take one sitting and four lying patients with satisfaction to all concerned.

Major S. A. McDonnell, D.A.D.H. of New Guinea Force, was appointed as the medical representative of the force in the coastal area, and remained at Soputa in a coordinating capacity. Further coordination was effected on 4th December by a conference called by the A.D.M.S., Colonel Norris. Here arrangements were made for Captain H. G. Bruce, Lieutenant Adam and twenty-three O.Rs. to take over the Popondetta staging post, and other personnel of the 14th Ambulance to relieve the 2/4th Ambulance at their forward posts as soon as possible. The remainder of the unit proceeded to Soputa in preparation for the complete relief of Hobson's

unit, which was now very tired and needing rest. In fact, owing to the depredation of malaria the 2/4th could not have carried on without the help of the 14th Field Ambulance. A week later the 2/6th Field Ambulance, having finished its work at Myola, moved on towards the roadhead of the mountain trail, and staged temporarily at Ilolo. So the two units, which with the help of the 14th Ambulance had carried the medical burden of the final phases of the Owen Stanley actions, were freed for a period of rehabilitation.

Popondetta Staging Post

On the 7th the number of patients held at Popondetta reached its maximum to date, 450. There was considerable activity of enemy bombers and fighters that day, especially over Buna, and no planes landed. Landings were expected at No. 3 strip, but though a party of fifty of the less incapacitated made the hour's march, they had to remain there, and arrangements had to be made to send rations and cooking gear for them. The Popondetta staging post party continued its activities under very fluctuating conditions. Weather, operational activity and shortage of motor transport produced unpredictable changes: sometimes the patients would go straight from jeep to plane, even at times with planes waiting while approaching vehicles arrived; at other times the post would overflow, exhaust its supplies and exceed the capacity of its workers. As many as 440 had been sent by air in one day. At this stage of the campaign the number of American personnel varied considerably: on occasion they numbered 40 per cent of the total evacuated. It was sometimes necessary to enlist the help of patients, and in this way a cookhouse for 180 men was built and manned. Only the most seriously ill could receive individual attention, and most had to fetch their own water, and a limited number of wounded men could be washed. Crowding in shelters was common when numbers rose, and mess gear was usually inadequate. Tents and tent flies were needed for independent shelters, and complete protection from the weather could not be given. Although prompt air evacuation was a blessing, and enabled men to be in bed in Moresby a very short time after leaving the airstrips, unfavourable conditions could alter the whole picture, and many anxieties were felt by those responsible.

The ordeals of a wounded man were considerable, even with the greatest care. He was often subjected to a difficult and hazardous carry to muddy Soputa, there to undergo operation by skilled hands, though under primitive conditions, and at varying intervals thereafter had to make another rough journey to a staging post at an airstrip. Here he faced some further period of waiting, during which he received all necessary care, but with little comfort, and then was quickly returned to an airfield at Moresby base, where a smooth organisation sent him on by a rather rough but efficient ambulance trip at last to find himself in bed in a tented or hutted ward, though still far from the mainland. It should be said that in spite of these calls on the fortitude of wounded men, their condition on arriving at the Moresby base was surprisingly good.

FALL OF GONA

Gona was subjected to a heavy assault early in December. The 30th Brigade had come under command of the 7th Division, and the 39th and the 2/14th Battalions went along the coast towards Sanananda, but could make little headway in the swamps. Gona was attacked by artillery and from the air, and during the 8th and 9th increasing pressure was applied till patrols found few survivors. Gona had fallen. Both sides sustained heavy losses: the four battalions of the 21st Brigade lost 530 killed and wounded and were 40 per cent below their strength when first they engaged the Japanese at Gona. Though the Japanese had relinquished pressure here, the same could not be said of Sanananda, where determined resistance was offered to the 30th and 16th Brigades.

Conditions were difficult between the front at Gona and the M.D.S. at Soputa. The rear A.D.S. on this track was at Jumbora where there were facilities for blood transfusion, and the forward post at Dunn's post. From the latter to Gona was about a three-quarter hour walk through kunai, and thence two hours' muddy march to Jumbora, from which a corduroy road stretched to Soputa, transit taking one and a half hours. Casualties were sometimes held overnight if it was too late for them to reach Soputa: they were usually from the 39th Battalion and elements of the 21st Brigade. After Gona fell these posts were still maintained, and used as brief holding posts for men with malaria, so as not to deplete the fighting ranks. An order was issued that no one would be evacuated sick with a temperature less than 104°, though men with a temperature of 102° were not sent out on patrols. Most of the casualties came from the Amboga crossing and considerable delays were not uncommon before they arrived.

In view of the heavy losses along the Sanananda track and the determined resistance, the corps and divisional commanders, Herring and Vasey, decided that no more full-scale attacks would be made on Sanananda at present. It was evident that something would have to be done to give adequate rest to the hard-worked formations which had been exhausted by fighting on the mountains and on the coast. There would also be need for experienced troops to replace them.

Relief and Rehabilitation. Early in December two important decisions had been reached by Blamey. The Atherton project was under way, and though it was as yet an official secret, Blamey had decided to send the 16th, 21st and 25th Brigades to the Atherton Tableland in North Queensland for rehabilitation. This project was designed to provide a spacious camp and training area with a bracing climate and without any malarial mosquitoes. Here men could be sent from highly malarious areas with every benefit to themselves and without any danger of communicating the disease to others.

Blamey's other decision was to bring Wootten's 18th Brigade from Milne Bay to take part in the drive on Buna. Little progress had as yet been made on this part of the front. Following the fall of Gona there was a relatively quiet interlude during which preparations were made for

further assaults on Buna and Sanananda. The 14th Field Ambulance was now assembled in sufficient numbers to take over the duties of the 2/4th Ambulance, and its members were placed in the M.D.S. and the forward posts in preparation.

MEDICAL ARRANGEMENTS

At midnight on the 16th the 14th Field Ambulance took over the M.D.S. at Soputa and on the following day Hobson transferred most of the 2/4th Field Ambulance to Popondetta, there to rest until they were flown to Moresby. A considerable number of the outgoing officers and men had already had malaria. Hobson stayed on with five officers and thirty-five O.Rs., who made up about half the unit, to help the 14th over the next few days. It will be realised that except for these experienced assistants from the 2/4th, Earlam's unit now held the medical position in their hands on the Australian Gona-Sanananda front. Captain L. V. Merchant and party, using A.A.S.C. men as bearers, set up a loading post near the 30th Brigade on the Sanananda track; Gatenby and Watson had gone to Jumbora, and the new surgical team, Captains J. I. Hayward of the 46th Camp Hospital and I. H. McConchie of the 5th C.C.S., at Ackland's request proceeded to Soputa to work there. Day arrived on the 18th December from Wairopi. A month earlier he had been holding six slightly wounded and 265 sick, most with mild diarrhoea. Fortunately he had ample cover and rations at this time, but the food available, tinned beef and biscuits, was not suitable, though he had welcome assistance from the local Angau representative at Wairopi, who provided fruit for patients. He was not able to establish successful contact with divisional headquarters during this period. Alexander and Hobson visited all the R.A.Ps. on the right flank, where further action was soon to take place.

Medical arrangements for this action on Sanananda Point were checked. The 49th Battalion needed some extra help, owing to its difficult location, and twelve stretcher bearers were attached to the R.M.O., who had to send them on a carry of an hour and a half from the aid posts through an area where natives would not go. This involved passage through the muddy jungle for about 3,000 yards and the crossing of a stream running waist-high between steep banks. For the first time since the beginning of the Owen Stanley action white bearers cleared the aid posts. It was evident that the real nature of the fighting north of the ranges was not realised by all at the base, as one medical officer arrived who had been advised that the warfare was static, and that his equipment could be packed in panniers instead of haversacks.

The bearers were armed because of the possibility that the Japanese, after being driven out from their strongholds, would break through Australian positions along the route. Later the work at the 49th Battalion aid post by the R.M.O., Captain J. D. Fotheringham, was aided by the establishment of the aid post of the 36th Battalion. From the A.D.S. to the M.D.S. the patients were carried by natives and by the converted

sedan. The work of the light aid detachment in keeping this useful vehicle practically constantly on the road was commendable.

Air Supply and Evacuation

During the early days of December heavy fighting continued, and in five days 166 battle casualties were admitted, some of whom came from the activities of patrols and other small groups. The assembly of the Allied forces along this most unpromising battlefield could not be accomplished quickly, but time was nevertheless an important factor, because tropical disease was rapidly and insidiously attacking the forces. The Australian success at Gona gave no promise of similar rapid victories, but certain advantages had by this time been gained. At Popondetta and Dobodura there were two reliable airfields, and already reinforcements, supplies and rations had been landed, while casualties and tired troops had been flown back to the haven of a base area. An airstrip had been laid down at Soputa also, but its surface was not reliable for take-off, as trial showed, and it was used only for dropping.

Early in December the American troops had initial encouragement in Buna village from which their newly-arrived III Battalion of the 127th Regiment had forced the Japanese on the 14th; by the 17th the coconut grove and the village had been taken, but these were not vital points in the possession of Buna. Assaults on the right flank produced little effect, and by the 17th there had been no substantial change in the position before Buna or Sanananda. American troops attached to the Australian 7th Division had previously succeeded in establishing and holding a position on the Sanananda track known as Huggins road block. Men of the 2/7th Cavalry Regiment attacked along the track, and on 19th December established another road block with Japanese holding the track in between the two blocks. The cavalry were in a most difficult position where parts of the unit were separated considerably from the rest. This made the collection of wounded difficult; some men could not be removed for long periods, up to three days. It is not surprising that some wounds were fly-blown, but a much more serious matter was the possibility of gas gangrene in this dangerous terrain. The surgeons at the Soputa M.D.S. were kept on day and night shifts, and tackled all branches of surgery. One difficulty at night was how to know when the last stretcher patient had arrived: staffs were too short to permit of messengers being sent.

Just after the middle of December, the expected 18th Brigade from Milne Bay began to arrive, and Brigadier Wootten took command of Warren Force, which included the 2/9th Battalion, and a troop of the 2/6th Armoured Regiment. The 2/10th and 2/12th Battalions were following.

The remaining members of the 2/4th Field Ambulance and those attached from the 2/6th Field Ambulance were released from further duties in the Gona-Buna area on 24th December, and after a period of waiting were flown back to Moresby and gathered in the Donadabu rest camp.

ACTION AT BUNA

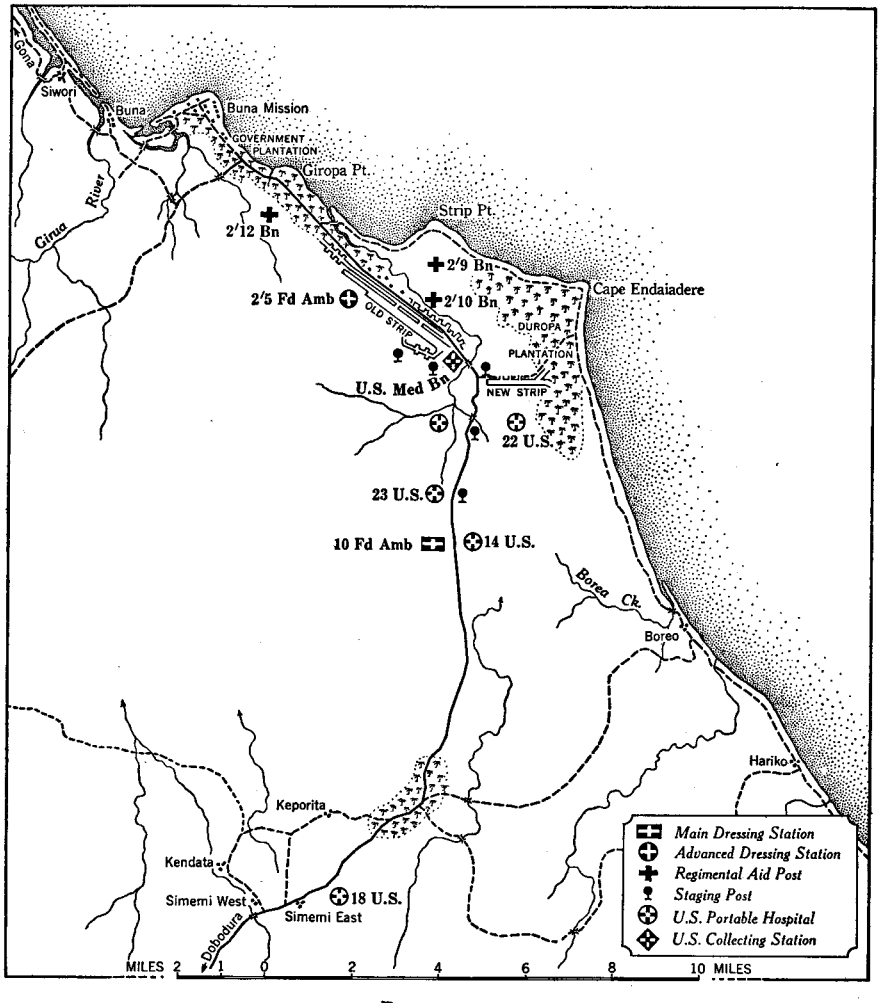
The phase of assault on Buna and Cape Endaiadere now began, and the participation of the 18th Brigade in the fighting called for special medical arrangements. The 2/5th Field Ambulance, whose companies had been used for forward work during the action at Milne Bay, had been used to service several of the detached military forces holding outlying areas from Milne Bay. A single detachment of this field ambulance was formed by fusion at the Buna front as its components arrived. Major Lavarack was in charge of the detachment, and brought part of it from Milne Bay, arriving at Buna on 15th December; in this section there were only ten O.Rs. Captain J. L. D. Scott's party included Lieutenant T. Raine and fifteen O.Rs., some of whom had been stationed at Wanigela and Porlock, areas being held for purposes of general security and, more significant, for the establishment and maintenance of air and sea transport on the north-eastern part of Papua. This party arrived at Buna with the 2/10th Battalion on the 17th.

Captain R. A. G. Holmes brought seven O.Rs. with the 2/12th Battalion from Goodenough Island, which had been held by an establishment largely façade, a successful deception which had discouraged the Japanese from further efforts to possess the island. This last section did not arrive at Buna till the end of December, but the sections together made a useful detachment of nominal company strength able to accompany the 18th Brigade to the Buna-Endaiadere sector in a determined effort to capture this important area. The equipment brought by Lavarack's party was somewhat unbalanced, but sufficed for the carrying out of its functions, which varied from that of aid posts to a main dressing station. Tentage, stretchers and blankets, medical companions, surgical haversacks, dressings, splints, transfusion apparatus, patients' utensils and cooking appliances, were carried.

The Milne Bay section travelled by corvettes, but only the battalion command group could be landed at Cape Endaiadere because of proximity of the Japanese, and the remainder was later landed at Oro Bay. Here some medical equipment was left to be brought up later and the party proceeded on foot through dense jungle and deep streams to the Buna area. A number of men fell out with recurrent malaria and had to be treated and then left to follow later with assistance. It was evident that Lavarack's party could not evacuate casualties without help from the Americans. Its first assignment was that of organisation of transport of casualties from the 2/9th Battalion R.A.P. by jeep and Bren carrier 500 yards to the A.D.S. of the 2/5th Field Ambulance, with help from American stretcher bearers if necessary. From here casualties were taken by native bearers from the 22nd United States Portable Hospital ten miles to Dobodura airstrip.

At Soputa the work of the 14th Field Ambulance detachment continued, but there was need for further assistance, as there was not an entire ambulance unit in the area for a period. The necessary help was supplied by the 10th Field Ambulance, commanded by Lieut-Colonel E. C. Palmer.

This unit disembarked on 28th November, and had been since at Port Moresby, where all ranks were temporarily employed with the 2/9th A.G.H. This brief tour of duty was appreciated by both the units concerned.



Buna area

In the second week of December Palmer was directed to prepare a detachment to work with the force in the Buna-Endaiadere area. This detachment included Major J. G. Johnson and Captain C. R. Copland, with twenty-eight O.Rs., and a surgical team was attached, under the direction of Major J. M. Yeates. Two plane loads of equipment and stores were taken with the party, a load of some 10,000 pounds. On the

morning of the 17th this detachment flew to Dobodura, where Humphery was acting as medical liaison officer. The stores were conveyed by jeep to Simemi plantation, and thence on the 18th December to a position beyond Hariko some three miles behind Cape Endaiadere. Here a dressing station was set up alongside the 22nd Hospital. Lavarack's detachment of the 2/5th Ambulance was established at a dressing station one mile behind Cape Endaiadere. Johnson had not known about Lavarack's party previously, though Lavarack was the S.M.O. of the 18th Brigade, but the two parties combined surgical forces. Johnson's surgical team and equipment were moved to the 2/5th dressing station and a theatre was set up in a pyramidal tent. On the next day surgery was being performed. Most of the battle casualties were treated by Yeates and his team with the 10th Field Ambulance, at the 2/5th dressing station, while Lavarack's detachment dealt chiefly with the sick.

The action for which these preparations were made was under the direction of Wootten. On the 18th the 2/9th Battalion was in action and with tanks of the 2/6th Armoured Regiment broke through the Japanese defences at Cape Endaiadere. The enemy lines were strongly fortified, and in the heavy assaults necessary to overcome them, the 2/9th Battalion sustained heavy casualties. The action swept right down to the sea, and near Simemi Creek the American troops supported attacks on some strong positions which were captured from the Japanese. Urbana Force made repeated attempts to take the "triangle" area at Buna, but as little headway was made here the force of the attack was turned on Buna Mission.

Warren Force now held a line extending from the new airstrip to the coast, where the 2/9th Battalion occupied the area. The 2/10th Battalion arrived on the 19th, and the Australian troops in the coastal sector made a determined attack on the following day, when practically all the country east of Simemi Creek was captured. During the next two days Urbana Force made some advances in the Buna area, but was not able to capture the mission. The swamps of Simemi Creek inland from Cape Endaiadere offered a serious obstacle, as the only tank crossing was strongly defended by the Japanese, but the 2/10th Battalion patrols succeeded in finding a crossing through apparently impassable swamp country. The Japanese withdrew and tanks were able to support the combined forces in an advance. Heavy enemy attacks were repulsed by the 2/10th Battalion, while the 2/9th continued to oppose enemy movements at the mouth of the Simemi Creek: the initiative remained with the Australian forces.

Urbana Force was still pressing on towards Buna Mission, but had not been able to reach through their corridor to the sea. The 127th Regiment on the 28th then made a successful attack, while still keeping the enemy within the "triangle" area, and found that most of the Japanese were withdrawing. The 2/10th Battalion was strengthened on the 30th by the arrival of the 2/12th Battalion from Goodenough Island, which then took over the attack. On 1st January, with the assistance of artillery and tanks, a drive was made right through to the coast against strong defences. The

American forces had by now overcome and pushed past the "triangle" defences south of Buna Mission, and were making for the sea. The 2/12th Battalion after a fierce struggle captured Giropa Point. Meanwhile the 127th and 128th United States Regiments had overrun the enemy defences at Buna Mission, and in a final attack captured the last enemy stronghold there. From 18th December to 2nd January the combined forces before Buna and Cape Endaiadere fought hard and continuously, facing great difficulties and hardships in the formidable obstacles of nature and the determined resistance of the strongly defended enemy. Naturally casualties were heavy.

MEDICAL ARRANGEMENTS FOR BUNA

As we have seen, the two Australian ambulance detachments fused with Yeates' surgical team from the 10th Field Ambulance to form an advanced operating centre. Casualties were received from the battalion aid posts and about fifty could be held for one or two days before sending them on to Dobodura. The decision to perform necessary surgery as far forward as possible arose from a discussion between Brigadier Disher, D.D.M.S. New Guinea Force, and Colonel C. W. B. Littlejohn, the Consultant Surgeon of the area. Only bare necessities could be taken so as to permit air transport; these included instruments, anaesthetics, dressings, drugs, plaster, medical, surgical and blood transfusion panniers, wet serum and four "Primus" heaters. Neither operating table nor autoclave could be taken.

Yeates and his team arrived at Dobodura on the day before the beginning of the attack. The only road was a muddy track which was passable for jeeps when the weather permitted. Therefore the team had to go farther forward, so as to be sure of receiving casualties within eight to twelve hours of their being wounded. After difficulties in obtaining transport the team made a muddy trip and met Lavarack's party. Already casualties were passing the two parties on the way back, but by sunset the theatre was being set up. A carpenter, brought for the purpose, had an operating table and other furniture made on the next morning, and by noon operations were being performed within a few hours of the wounding of the men. Movable trestles were made so that the patient could be placed on the edge of the tent in good light if the weather was fine. A very wide range of surgery was performed with simple equipment, and without being unduly radical the team found it wisest to follow the routine of "excision" even for simple perforated wounds, having regard for the dangerously infected soil.

During the period 19th to 23rd December the Australian ambulance detachments worked in cooperation with the 22nd United States Portable Hospital; on the 23rd this hospital moved forward next to the 2/5th dressing station, and the next day the 10th Field Ambulance detachment joined the dressing station. Copland was detached to replace Captain A. H. McGregor, R.M.O. of the 2/9th Battalion, who had been wounded.

EVACUATION OF WOUNDED

Most of the wounded arrived at night, and the small number of medical officers sometimes found it hard to cope with the work. Trial was made of operating on day and night shifts with two teams, Yeates' and Scott's, but this was quite impracticable, as the officers had to work by day and at night whether they were in the theatre or not. The dressing station was only thirty yards from the beach, and strict blackout was necessary: the theatre tent was khaki; a dark green tent would have been easier to black out, as the pins and blanket method was not very effective. On the 27th the brigade commander instructed that another site be chosen. Most of the area was kunai or sago swamp country, but a site was selected in jungle; this shortened the line of evacuation from the 2/10th Battalion and gave a better road. The move was effected with interruption for only half a day in the theatre.

Trouble arose later when the evacuation line from the 2/12th Battalion was found unduly long, and another advanced station was necessary; a site was selected with good cover, and just high enough to be dry above the neighbouring swamps. The siting of a dressing station was made doubly difficult during an action in this country, with its poor alternatives of kunai grass with no cover, or swamps with poor access and few dry spots. These difficulties of terrain also multiplied the trials of casualties and bearers. During the last two days of the Buna action the stretcher bearers worked all day and most of the night. Humphery had previously applied to New Guinea Force for more bearers, but problems of transport caused delays. During 1st January 151 casualties were sent to the M.D.S.; with a long carry over swampy ground this meant great effort to the bearers. A certain amount of transport was saved by holding sick men for a day or two if they appeared likely to make quick recoveries, when they could be returned to their units.

Some troubles arose with wounded patients being staged to Dobodura. Attention *en route* had been left to the 18th United States Portable Hospital at Simemi, but it was found that more special care was needed. Men could not be spared to man a light section post, but for several days after 31st December a nursing orderly and another orderly were sent back to Simemi equipped to give hot drinks to all the native carriers and the patients able to take them. Wound dressings were adjusted if necessary and morphine was given as required. No transport over this track was possible at night, so no night-time service was required, but this simple plan appeared to work well.

In this last phase of the Buna action on the night of 2nd January seventy-seven patients were held in the 10th Field Ambulance M.D.S., fifty were sick and the remainder battle casualties, many of whom could not be moved. Rain had fallen during previous nights, and on the night of the 2nd-3rd the area was swamped by a heavy downpour and was most uncomfortable next day. Further movement had been planned for the 10th Field Ambulance; it had proved its value in rapid evacuation to Dobodura. On 21st December the D.D.M.S. New Guinea Force was

arranging that Palmer, commander of this unit, should go to the Buna area to take charge of medical arrangements. Lieutenant J. E. McGill, bearer officer, and twenty-four O.Rs. were sent to Dobodura as reinforcements.

On 29th December a detachment under Major H. V. Francis left Moresby by sea and arrived at Oro Bay with a quantity of stores. This party was directed to march to the Buna area; leaving a guard to look after the stores and bring them round by barge, Francis reached Soputa on 7th January. Unfortunately the barge sank off Hariko, and its cargo was lost, with the exception of a number of panniers which were later recovered. The remainder of the unit was then to proceed by sea to Oro Bay under command of Major I. A. Wilson. There they arrived on 6th January, and proceeded to the 1st United States Portable Hospital at Eroro Mission five miles away. Japanese planes bombed the wharf area while their ship was being loaded, causing a number of casualties. A rear party was left at Oro Bay and the remainder moved to Soputa on foot and on the 17th were accommodated at the M.D.S. of the 14th Field Ambulance.

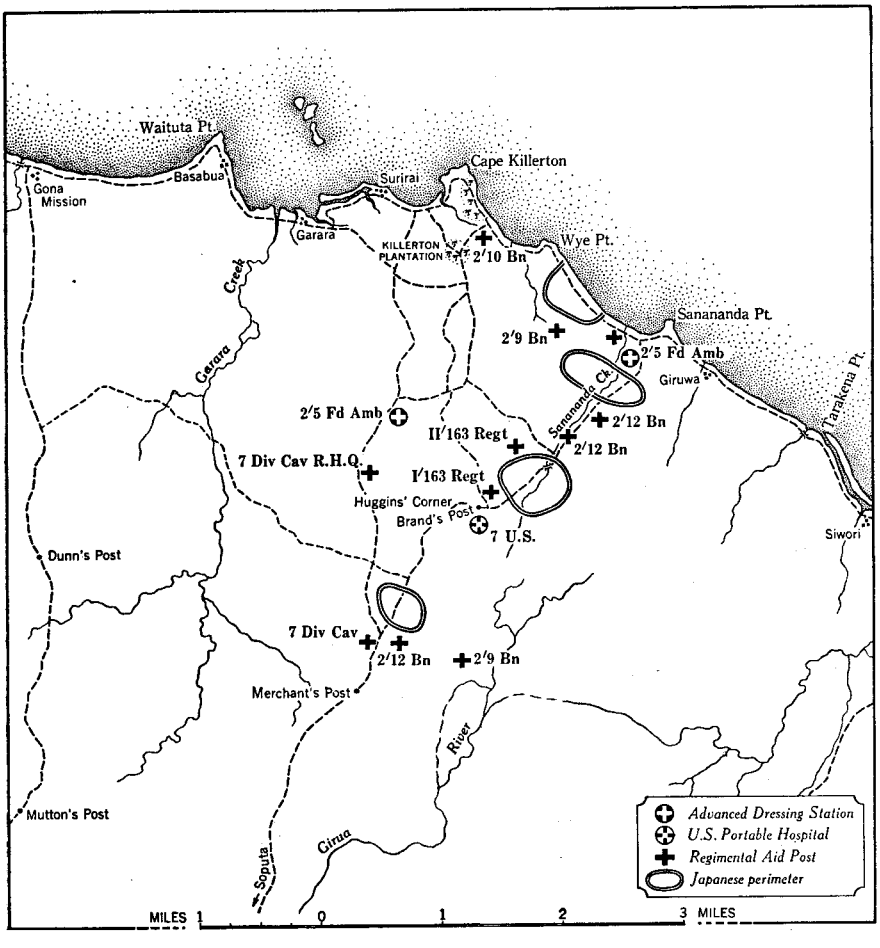
ATTACK ON SANANANDA

Even when Gona and Buna were disposed of as enemy strongholds there still remained the problem of Sanananda. After the capture of Buna the 163rd United States Regiment began to arrive, and Vasey planned to use these new arrivals and the 18th Brigade to clear the Sanananda track. By mid-December the 18th Brigade had taken over the main Australian positions; the American troops were forward in the region of the road block positions and were astride the Killerton branch track above its junction with the main track; the newly constituted 14th Brigade (36th, 55th/53rd Battalions) was settled on the left flank, and the 30th Brigade (39th and 49th Battalions and the cavalry) held the main Sanananda track and the ground northward to the Killerton track. Following the fall of Buna the 18th Brigade came under command of the 7th Division, and a week later relieved the 30th Brigade on the track.

Norris, Earlam, Palmer and Alexander conferred about the medical arrangements. They decided that the whole of the 14th Field Ambulance should now be concentrated at the M.D.S. at Soputa, and the 10th Field Ambulance should therefore take over the post at the Popondetta strip with three officers and ninety men. Twenty of the 10th Ambulance men were also at Soputa to act as stretcher-bearers.

The surgical team with the 18th Brigade was brought to the Soputa M.D.S. to work; this included Major J. M. Yeates and Captain Scott. Major D. M. Yeates of the 2/2nd C.C.S. also worked for a short period at Soputa. The presence of Colonel Littlejohn was of immense help to the staff at Soputa; his assistance and advice were much appreciated by the surgeons throughout the whole action. The remainder of the 2/5th Ambulance detachment was also to work at Soputa, and in preparation for the expected advance of the 18th Brigade on Sanananda, a reserve medical post under Holmes was formed before the move on 10th January.

Twenty stretcher bearers were also in readiness to work from the Sanananda post in clearing the battalion casualties. The movement of casualties in the Killerton-Sanananda sector was placed under Lavarack's control. Ackland's surgical team was now to return to Moresby, and to be replaced by Majors E. P. Row and R. C. Huntley.



Sanananda area

The attack on the Sanananda sector began on the 12th. After heavy artillery bombardment the 2/9th and 2/12th Battalions with one troop of the 2/6th Armoured Regiment attacked the heavily guarded positions of the Japanese on the Sanananda-Cape Killerton road junction. Casualties soon began to come in, and the surgical teams at the M.D.S. worked double shifts both day and night. The work was supervised by Littlejohn, and all battle casualties needing operation had been treated by the early

morning on the 13th. Both organisation and surgical standard were at a high level, and the centre was an excellent training ground for all ranks.

The weather was very bad and heavy rain on the coast made the forward tracks heavy going even for jeeps, and additional native carriers were provided to transport wounded to the dressing station. There was no air evacuation on the 12th as clouds prevented planes from landing and the next day only twenty-nine men were moved by plane from Popondetta. Fortunately it was a quiet day at the M.D.S. owing to the abandonment of a planned attack on the front. Only eleven battle casualties were admitted to the M.D.S. on the following day; this eased the strain at Popondetta, where the heavy rain had flooded many of the wards, robbing both patients and staff of sleep. Popondetta strip post was now holding 615 patients. Saturation point had been reached; blankets and food were scarce, though extra tins of food were produced from little private stores in the packs of some of the patients. The strip organisation could carry on one more day without further air-lift, but after that patients would have to be taken to Dobodura by native carriers.

On the 14th, conditions improved and 436 patients were evacuated by air to Moresby. This eased the strain on the M.D.S. at Soputa and its staff. The Japanese were retiring from the forward zone, and further attacks on them were planned for the next day on Sanananda and Killerton. Further advances were made by the 18th Brigade and the 163rd United States Regiment and Holmes was sent on with the brigade. Row and Huntley's team had now arrived at Soputa and Ackland's was returning to Moresby.

Disher also arrived on the 15th and visited the posts. Merchant's post was now known as the rear Sanananda post: it was realised that seriously wounded men would have to be taken there by native carriers, and those able to sit up, by jeeps. A surgical team was sent to carry out life-saving procedures. An extra staging post which could be moved forward when the road was cleared for motor transport was formed from some of the 10th Ambulance staff who had recently arrived at Soputa.

Up to the 16th, casualties had been lighter since the heavy losses of the first phase of the attack, but during the next few days the numbers rose again, owing to more activity on the front. By a rapid movement Cape Killerton was taken by Vasey's force, and the 2/9th and 2/12th Battalions penetrated almost to the beach on the main track. The Japanese abandoned their prepared positions, leaving the jungle torn and blasted by the attack, and flooded with the recent torrential rains. The attackers too suffered the discomfort of the coastal swamps, but the worst was over, and the 2/9th Battalion found on the 18th that the area to the north-east was not strongly held. Later this day Sanananda was captured, and Australian patrols penetrated as far as Giruwa.

The Japanese still held out in several pockets of resistance which needed strong attacks from the 2/9th and 2/12th Battalions. Once a route had been found through a swamp into the enemy's central defences, a concerted move was possible from each end of the beach and from the centre. The 163rd

Regiment tackled a large pocket of Japanese north of the post on the Sanananda track known as Huggins and cleared this up entirely on the 21st. By the next day the last resistance of the Japanese forces was overcome and the Sanananda area was entirely in Allied hands.

CARE OF CASUALTIES

After dark on the following day thirty-four battle casualties were admitted to the M.D.S. at Soputa. Before dawn ten inches of rain had fallen, flooding the wards; one tent holding casualties collapsed, but before long all patients were dry and comfortable. Two surgical teams worked all night, and performed thirty-nine operations during the dark hours. Only one theatre was blacked out and could work continuously; the open theatres could not be used all the time as enemy aircraft were overhead, but work went on with only brief periods of intermission.

The tour of duty of the 14th Field Ambulance was now coming to an end, and the 10th Field Ambulance was to take over the M.D.S. at Soputa. During the lull consequent on the fall of Buna, Lavarack's detachment of the 2/5th Field Ambulance took the opportunity of sorting and packing equipment and making up deficiencies. There was considerable difficulty in moving this equipment, but eventually it arrived at Soputa intact. On 15th January the detachment marched to Soputa and was attached to the M.D.S. A light section under Holmes moved to join a forward section of the 14th Ambulance, where it had the assistance of bearers of the 10th Ambulance. On the 17th the remainder of the 2/5th detachment at Soputa reinforced this light section, thus enabling the post to act as an advanced dressing station for the rest of the action.

It was proposed to follow the brigade attack along the Killerton track and send casualties by jeep to Soputa. This plan was followed, but there was no track suitable for jeeps, and as the brigade split into three battalions, each on a track leading towards Sanananda and Killerton the problem of evacuation became much more difficult. Bearer squads were attached to each R.A.P. as it moved on and casualties were taken from all three battalion aid posts over distances which increased until some were up to 4,000 yards. The carries had to be made through the worst jungle country encountered so far, and from the 2/10th Battalion the route led through mangrove swamps to the coast. This work was done by the 2/5th Ambulance bearers, but as time went on native porters going up with supplies and ammunition brought patients back on their return.

On the 19th the 2/9th Battalion took Sanananda Point, but the 2/12th was still held up on the track. To overcome this difficulty a direct route was found and used with success: it led farther back on the Sanananda road round the road block and so to Soputa. The picking up and transportation of sick and wounded in this area were extremely difficult.

This is well illustrated by an episode which centred round Brand's post, an additional aid post on the Sanananda-Soputa track. Captain N. E. Brand of the 10th Field Ambulance formed a forward dressing station on the 20th at Huggins corner on the road, and was able to bring wounded

from the 2/12th aid post over a track of over two miles to his post. Squads of six stretcher bearers were used over four separate sections of this route. Later in the day the number of casualties was too great for this to be done adequately, and 150 natives were sent to Brand's post to augment the ambulance bearers. They did not arrive at the battalion aid post till 7 p.m., and as most of the carrying would have to be done in darkness an escort party was provided by the divisional cavalry. As darkness fell heavy rain further obscured the muddy and treacherous track with only signal wires as a guide. The casualties began to arrive by 9.30 p.m., wet and exhausted, to find Brand's post covered with water, and with the swamp rising. The best course was to send the patients on; jeeps were commandeered and men posted along the Sanananda trail. A few patients went through the 7th United States Portable Hospital at Huggins corner, 300 yards from Brand's post, but before midnight thirty-four casualties were safely at Soputa, only one man with malaria being kept at the post. This journey was not only hazardous from the nature of the country but dangerous from the proximity of Japanese. Sergeant J. R. Urquhart of the 10th Field Ambulance, who was in charge of the bearers, found that the torrential rain made such a din on the trees that the noise of the large party was well disguised.

When the 2/10th Battalion cleared the last of the Japanese bands from the coastal front and joined the 2/9th and 2/12th at Sanananda, the A.D.S. moved to Sanananda Point with help from native bearers and thence went with the brigade back to Soputa. The 2/5th Ambulance party moved to Dobodura on 11th February and thence was flown to Moresby.

The 10th Field Ambulance, like other units whose versatility was proved by being used in sections and detachments of various sizes and functions, took over the responsibilities of the M.D.S. from the 14th Ambulance at Soputa on 25th January, a few days after the military situation on the northern coastal plains had successfully stabilised. Earlam and his unit arrived back in Moresby on 3rd February. From 18th December to 25th January, 694 battle casualties and 2,902 sick had been admitted to this M.D.S. Scattered small bands of Japanese were found for several days afterwards, but the problems of the medical units were then those of final evacuations of small numbers of wounded, and still considerable numbers of sick.[1]

In the Killerton-Sanananda area evacuation of wounded was controlled by Lavarack under the direction of the A.D.M.S. of the 7th Division. Almost a company of the 10th Field Ambulance was employed in this task, including the staff of Brand's post which has been referred to already. In its various degrees of sub-division and later of concentration, the unit was at Oro Bay, Buna area during the action, and Popondetta where the work of the airstrip post was taken over.

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[1] Australian casualties at Buna-Gona-Sanananda 14th Nov 42-22nd Jan 43: killed in action 107 officers, 1,154 other ranks; wounded in action 133 officers, 2,076 other ranks.

During the spell of bad weather late in January considerable difficulties were encountered at Popondetta. Planes landed on the 21st, but there was considerable delay before they could take off with patients, owing to the wet state of the runway. Some medical officers felt the need of unified control in such matters; they realised that delays and even indecision were sometimes unavoidable, though they might cause fatigue and discomfort to patients brought some distance to await transport. Patients had to be moved next day to the other end of the strip, as planes were ordered to land south to north; nevertheless several planes landed north to south. Nearly 500 patients were held at the strip that night, but fine weather permitted all to be flown to Moresby by early afternoon. These fluctuations gradually smoothed out as numbers dwindled, and delays did not interfere with the treatment of casualties so far as this was possible at Popondetta.

Adoption of Atebrin

With continuation of malarial treatment there was as a rule no difficulty. At the beginning of February arrangements were made to return to their units American servicemen who had begun the second stage of their treatment. It may be noted here that atebrin had become the official suppressive drug at the end of December in the Australian armed forces. On 7th February the remaining patients at Popondetta were flown back, and the ambulance detachment then closed down. After this, patients returning to Moresby by air were sent from Dobodura and if necessary held by an American medical unit. Angau supplied natives to help in clearing the area, and, leaving a small rear party, the members of the 10th Field Ambulance at Popondetta were taken to Soputa. Some were attached to the M.D.S. for duty, and a party of forty-one proceeded to join those at Oro Bay.

On 2nd February Palmer was instructed to send a company to Oro Bay for Australian soldiers in the area. He went to Oro Bay to examine the stores left there previously, but had some difficulty in travelling by jeep as the road to Dobodura was often under repair. Therefore the party was despatched from Sanananda Point by schooner to Oro Bay on the 4th, under charge of Johnson. Another detachment sent later by road convoy was held up for several days until the 22nd. Other parties of fit men travelled to Embogo on foot and thence by launch and jeep to Oro Bay. By this time the M.D.S. at Soputa had been closed, and arrangements were made with the divisional surgeon of the 41st United States Division and the regimental surgeon of the 163rd Regiment for the care of small Australian units still in the area served by Soputa. The rear party left Soputa on the 23rd and rejoined the unit at Oro Bay. The site occupied by the camp hospital here was on high ground. Constructional work was slow at first with a depleted staff, and the provision of a water supply, one of the frequent paradoxes of these wet areas, was not altogether easy. The commanding officer at last had most of his unit in one place, and established his official headquarters there.

MEDICAL AND SURGICAL WORK

In some ways it would be difficult to conceive of more diverse conditions for the performance of medical and surgical work than those existing at the Moresby base units, on the Owen Stanley Range and on the Gona-Sanananda-Buna front. Yet the same principles infused each of them, the same call for improvisation, the same adherence to the essential tenets of surgery.

It was most important to site the main dressing station so that casualties could be transported without undue difficulty or delay, and desirable also that the next stage of evacuation should not be too long or unreliable. When the M.D.S. at Soputa was first set up by the 2/4th Field Ambulance these considerations were heeded, and wounded were given all necessary surgical attention as far forward as was safe. Similarly the dressing station used by the 2/5th and 10th Field Ambulances during the battle for Buna and Cape Endaiadere were designed to give service where it was most needed.

The question of cover for medical units was of particular importance in this country. There were open areas, but some of these were proved unsafe by events, and others were impracticable as they were swampy and readily flooded. The unfortunate experience of the air attack on the Soputa M.D.S. showed that it was better not to select an open area, even though under the apparent protection of the Geneva emblems. The question of the relative safety of forward dressing stations was considered in one of the reports of the D.D.M.S. New Guinea Force. Major Day, commanding the American 2nd Field Hospital near Simemi, had the experience of being bombed with his unit on the Dobodura strip before they had unpacked. Some days later when the hospital was set up in an open space, enemy planes flew over but left the unit undisturbed, but on two subsequent occasions they were again attacked.

The 17th United States Portable Hospital was sited three miles north of the Australian M.D.S. at Soputa, in an uncomfortable place near the Australian 25-pounders, and exposed to "searching fire" from the Japanese. It is questionable if good work can be done in such locations without exposing the surgical staff to undue strain, apart from considerations of safety. The Australian view was rather to compromise between the advantage of forward work and safety with relative quietude. Palmer in reporting on the siting of dressing stations, stated that "the jungle gives perfect cover and must be used". The risk of clearly visible tracks of access had to be remembered too; patches of kunai grass were higher and therefore on drier ground, but jeep tracks could easily be seen from the air. In re-siting dressing stations during the Buna battle suitable jungle patches could be found, but these were usually on swampy ground, and a suitably dry yet protected area was not easy to find. Here both an A.D.S. and the M.D.S. of the 10th Field Ambulance were finally placed on areas barely above swamp level, but the choice was successful, though a few days later heavy rain altered the whole picture. These sites made hygiene difficult; water was drawn from shallow wells and was chlorinated in

Lister bags or in the valises of E.P.I.P. tents. Sanitation was provided by deep-trench latrines where possible, but the high water table sometimes made building up necessary. In some of the wet areas guide tapes such as bandages were essential to mark the paths.

Accommodation was usually in tents, but when possible native type huts were found very useful. The American pyramidal tent was found to make a good theatre, especially if the height of the pole was raised. E.P.I.P. tents and marquees were also used. Care had to be taken that cover was not sacrificed by the men cutting trees for tent poles. Lighting at night was difficult because of the imposed blackout, but overlapping blankets fastened to the sides of the tent were reasonably effective. Layers of palm leaves on the roof assisted the natural growth of trees in preventing escape of light from the theatre at night. Pressure lamps were effective but fragile; Yeates' team found jeep headlamps better; these were run off batteries which were kept charged by the signals unit. A surgeon's electric headlamp and good torches were most valuable, and enabled an operation to proceed even with aircraft overhead. Operating tables were usually improvised from material at hand as only limited loads were permissible in air transportation.

Preparation of patients was a much more difficult procedure than in the warmer parts of the Middle East. The long green garments of the jungle-fighter were soaked in sweat and mud, and often covered with blood. The majority of wounds involved the extremities. It was found simplest to undress the men and wash them if conditions permitted; the exposure was harmless except in the presence of severe shock when more care was necessary, and the practically universal use of morphine simplified matters. Intravenous anaesthesia was once more a blessing, and could be continued for an hour if necessary.

Triage, or the selection of patients with regard to surgical priority, often required great judgment, especially when batches of wounded men arrived in quick succession, when lists would need drastic revision. The officer responsible for admissions had also to be sure that a complete examination of each patient was made, that transfusion was begun when necessary, and that care was exercised to limit loss of blood. Sufficient room was necessary for the reception of patients, their preparation, and if necessary resuscitation, and also for the storage of their belongings.

Theatre "linen" was of course restricted. Towels were found very useful and constant washing and boiling kept supplies up to a reasonable extent. Ground-sheets under the patients and water-proof "jaconet" over the table served their purpose well. The surgeons usually wore water-proof aprons. All swabs and towels were sterilised wet by boiling, as autoclaves could seldom be carried. The selection of a team was important. If the team was self-contained the majority of its orderlies were employed for nursing, cooking and general duties, and men were specially selected for theatre work. Some of these had been at least partly trained, and some most successful members, endowed with keenness and intelligence, soon became extremely competent. Under the spur of necessity and constant

supervision some orderlies became excellent assistants, carried out theatre routines faithfully, and could even learn to give anaesthetics and transfusions of blood.

Ackland pointed out in his report some most important considerations concerning the surgeon himself; these were chiefly the scope of his work, and the need for rest. He might be able to handle ten major cases in twelve hours, with perhaps five more less serious in addition. In the foul muddy swamps of these plains the risk of infection was great, and gas gangrene might ensue. Therefore prompt operation was often necessary, and amputation might be imperative. If wounded continued to come in a stream, no surgeon could continue to work at full pressure, unless the emergency was brief and temporary. Twelve-hour shifts were therefore most desirable. Ackland gave the instance of the Sanananda battle at its height, and stated that "when one hundred casualties arrived at an operating station within a few hours, five surgeons were found to be necessary to avoid delay in operating, and a high standard was thus achieved".

Previously-trained orderlies of course reduced the strain on the surgeons. Good organisation in a forward operating centre was conducive of good training in all members of the staff. Where teams were attached to an M.D.S. good relationships were established. It is significant that three different field ambulances were in charge of the M.D.S. at Soputa during this campaign, and worked with several surgical teams. The staffs concerned built up a reliable organisation, in addition to supplying an excellent technical service, and the training thus carried out improved the standard of work of all ranks. When the 18th Brigade began its final attack on the Sanananda positions Littlejohn directed the surgical policy of the centre, and even relatively untrained orderlies benefited greatly by the concentrated experience they gained.

Methods of evacuation. These have been described in typical stages. The battalion stretcher bearers had some trying and dangerous carries to perform. It was thought safer to dispense with brassards, as these were conspicuous even in the jungle. Troubles arose over stretchers. Native litters were loaded on to planes direct, but sometimes had to be cut down with a saw to conserve space. Ambulance type stretchers were often scarce, owing to their non-return. As flying conditions were stabilised these troubles were adjusted. Natives were sometimes available for transport from the aid posts onwards, and where tracks were rough, particularly those of corduroy type, wheeled vehicles made uncomfortable travelling. The overcrowding of M.D.Ss. after an influx of wounded was difficult to avoid when the weather was bad enough to prevent planes from landing on the strips. This caused an almost impossible situation in the strip posts at times, but these crises like others passed without serious results. The transport plane was the pivotal point of evacuation on this front, although its organisation represented the concentrated efforts of a large number of people. The Australian sick and wounded owed a great deal to the American air transports. Jeep transport on the intermediate stages was

also invaluable, and though other duties demanded priority at times, the utmost consideration was given to the casualties. When evacuation from the M.D.S. began to slow down owing to lack of vehicles, the Army Service Corps would send extra vehicles to cope with a rush. Coordination in various departments and between the Allied organisations was greatly helped by the work of medical liaison officers such as Major Humphery and Major C. C. Wark.

It was in these early campaigns in New Guinea that the foundation of organisation was laid for the handling of casualties in forward areas. R.M.Os. in forward units, on account of the long evacuation line, formed forward R.A.Ps. These were staffed by the R.M.O., a corporal and three orderlies, who carried and used personal equipment. In addition a rear aid post was used, consisting of a sergeant, a chaplain, the rest of the orderlies and three or four carriers. All sections sent out on patrol were accompanied by a trained stretcher bearer orderly who was often armed as well as medically equipped.

Amenities for sick and wounded. An important adjunct to the comfort of patients was the supply of comforts by the Red Cross, the Comforts Fund and other charitable organisations. These stores were flown over when possible and were distributed at the airstrips and Soputa, where they were of the utmost assistance in increasing the well-being of the sick and wounded. Services which provided hot drinks at the airfield of departure and arrival were also much appreciated. In addition to these an official supplement to the standard ration was supplied to medical holdings. At Soputa Humphery arranged a supplementary issue on the scale of 200 patients for a week which arrived through medical channels.

Angau. Captain Vernon of Angau was again concerned about the rations available for his native carriers. After the drive on Sanananda had begun he approached Humphery to see if an extra amount of fat could be added to their diet. He suggested that dripping and if possible cod liver oil be sent to the native hospital at Popondetta with weekly maintenance rations. He had noticed that many of the 250 or more native patients he was caring for were quite emaciated. The request was passed to New Guinea Force.

Attention was given to the food for patients in native hospitals, and a unit of supplementary ration was made available for them. No formal scale was laid down for these hospitals, but the military scale was considered suitable. Their chief needs were carbohydrates and sources of vitamins. Humphery remarked in a letter to the D.D.M.S. that Vernon himself was exceedingly thin, and unless he had meals with other members of Angau he ate very little, and indeed would give away to the natives any special food which he was given. Following these enquiries a case of special mixed food was sent to Angau at Popondetta for Vernon's personal use.

TYPES OF WOUNDS

Chest Wounds. The usual method of suture was adopted for "sucking" wounds. It was observed that a wound which gave no evidence of com-

munication with the pleural cavity at the aid post might do so on arrival at the M.D.S. It was practically impossible to maintain these patients in the sitting position and they usually arrived in poor condition. An answer was found to this problem by having natives make a back-rest on American Stokes litters, consisting of blankets lashed over a framework to the litter. Littlejohn later designed such a back-rest for routine use with the Stokes litter.

Abdominal wounds. Effusion of blood was nearly always present and transfusion was necessary. The extent of wounds over the right lower ribs was difficult to estimate, and study of rigidity and of the assumed track of the missile was necessary. It was important not to overlook wounds of the colon. Wounds of the buttock were misleading, as the pelvis and its contents, including small intestine, might be damaged. Ackland laid it down that a buttock wound was one of the most difficult for exact diagnosis, since so many visceral, nervous or bony complications might exist. Even excision was not easy to carry out except with a bold hand, and this was imperative to avoid sepsis. The mortality in abdominal wounds was high, but some astonishing recoveries took place: one of Yeates' patients was completely covered with coarse sea sand, and the intestine was extruded with multiple perforations, and yet survived.

Head wounds. There were not many of these, but only those men were operated on who were likely to benefit, and in busy periods only those who were partly or wholly conscious.

Wounds of limbs. A really serious problem was the lack of control of the femoral artery by tourniquet resulting in severe loss of blood. Fractures of the femur did not do well, and Yeates suggested in his report that the best treatment for shattering of the femur might be amputation. Resuscitation was applied after bleeding had been controlled, directly or with an Esmarch bandage. Ackland made special reference to the danger of wounds of the popliteal artery, and considered that immediate amputation was often required in patients whose further evacuation to Moresby might be delayed by bad weather conditions. Lesions of the arms were not infrequently associated with nervous damage.

Gas gangrene was recognised as a distinct danger during this campaign. From 1st November 1942 to 28th February 1943, 82 (4.5 per cent) of 1,815 Australian battle casualties admitted to the 2/9th A.G.H. at Moresby had clinical gas gangrene. These men were wounded in the Owen Stanley and Gona-Buna campaigns; twelve of them died. Over 100 cases of anaerobic infection were seen, but some of these were saprophytic in type. Lieut-Colonel K. C. Ross and Captain W. P. Ryan, who studied this series found that shock, rapid blood destruction, discomfort and mental unrest were constant signs.[2] All had received sulphonamides in standard doses and fifty-one men were given antitoxin. The effect of the antitoxin was difficult to estimate, but there seemed no doubt of the value of repeated blood transfusions. The most important aspect in this series was the value

[2] *The Medical Journal of Australia* 8 July 1944.

of surgical excision. Treatment in this campaign, as we have seen, was early, but it was not always possible in the very bad conditions on the coastal plains to examine every wound meticulously; this could only be done in a relative sense because of anatomical or pathological considerations. Observations made at Moresby showed that gas gangrene occurred most frequently in wounds which had not received sufficient radical attention. After the campaign was over, Littlejohn conferred with the surgeons who had worked at the advanced posts, and they produced evidence from their individual notes and the subsequent progress notes that adequate excision or *débridement* was a valuable safeguard against clinical gas gangrene, which was more commonly found in neglected or partially treated wounds in which muscle and blood vessels had been seriously damaged. Yeates summed up the situation "one is bound to remark that battle casualties in New Guinea demand early and very radical surgery".

Resuscitation. Resuscitation followed the lines laid down in the Middle East, and the set-up of admission and resuscitation tents was similar to that used in Libya. Trestles were made of logs running the length of the tent or series of brigaded tents, and on these stretchers could be placed at a convenient height. Here patients were examined without being further moved and if necessary transfusions were given. In this campaign X-ray units were not brought up to forward posts. Heat was not required except to a limited extent for cold and shocked men, and here hot water-bottles sufficed.

The possible dangers of transmitting malaria were disregarded if blood was badly needed, as any infections caused in this way could easily be cured. Blood films from prospective donors were obtained in the M.D.S. and examined for parasites. Occasionally members of an ambulance unit were used as donors, when no suitable donor was to hand and the need was great. Patients often had a rise of temperature after transfusions of blood, and frequently parasites were found on examination. This was no doubt due to suppressed infection.

When whole blood was used, complete reliance was placed on the blood grouping carried out on all soldiers on enlistment. Severe degrees of shock were not common, possibly because of prompt treatment, but if required, intravenous fluids were freely given in the form of a litre or more of blood, or wet and dry serum. As a rule serum was given, and with good results, but blood from volunteer donors was also used if necessary, though no stored blood was available. Intravenous saline or Ringer's solution was used as a post-operative measure where hollow viscera had been perforated.

Fatigue in Tank Crews. During the action at Buna some information was gathered concerning fatigue of crews of "General Stuart" tanks (American M3 light tank) and embodied in a report by Captain H. I. McKenzie, the R.M.O. of the 2/6th Armoured Regiment. This was based on enquiries made from 100 men, including tank commanders, drivers, gunners and wireless operators, whose average age was twenty-three and a half years. Height was a significant factor in fatigue particularly in men

over 5 feet 11 inches in height; lack of previous experience in arduous work also contributed to fatigue. Malaria introduced a complication; sixty-six of these men were infected, a high figure when compared with battle casualties, fifteen in number. Though tanks were rarely used at night, and the crews spent the night in a harbour area the men had little or no protection from the heavy rain, which did not encourage the use of mosquito nets. McKenzie recommended that tank crews should sleep off the ground in these malarious areas, have efficient cover and use nets.

The commonest symptoms noted in members of crews showing fatigue were headache, anorexia, nausea, faintness and breathlessness. Eye strain was also common, owing to the irritant effect of fumes, and the continual strain of looking through narrow slits and prisms, especially when these were fogged and when excessive sweat ran down the forehead into the eyes.

Some loss of weight was noted during the period of action: the average amount was estimated at 15 pounds; this was only an estimate, but the loss was definitely greater in men who contracted malaria. No evidence was found of cramps or other symptoms due to salt lack. It was found, however, that men who did not have a proper meal before action were more likely to suffer from headache; the men attributed their loss of desire for food to excitement. During action, crews welcomed dehydrated fruit rations and chocolate, but not milk tablets, which increased thirst. Most of these tank crews experienced faintness and breathlessness. These symptoms were connected with the presence and density of fumes in the tanks. Even with the engine running rapid firing produced more fumes than the ventilation system could cope with, and with the engine disabled further fighting increased the density of the fumes. Some men were completely overcome and had to be propped near an open port. The crews stated that these fumes came from the 37-mm. gun, which had an ammoniacal content, and the symptoms were accentuated by the heat and humidity.

McKenzie estimated that crews could tolerate up to seven and a half hours of duty in a tank, after which their fighting efficiency declined. Such decline was rapid after this point had been reached, and twelve hours of continuous action brought about a state of indifference even to personal danger. The men thought that a day of five hours' fighting was a reasonable limit if efficiency was to be maintained for seven days of continuous action. The R.M.O. commented that the conditions prevailing at Buna were responsible for this figure, which was low by comparison with the desert fighting. At Buna not only was the heat humid and excessive, but the tanks were closed down, and did not go into action with turrets open as in the desert. The discomfort of wet sleepless nights must also have been significant as a causal factor of fatigue. A final factor of importance is that of the cohesion of tank crews. Crews trained as a team felt much happier if they went into action together, and still more confident if they were associated with infantry units whose members had also trained with them.

The United States Medical Services. Major Humphery visited the American medical units in the neighbourhood of the airstrips so as to be familiar with their plans for the area. The American and Australian medical services cooperated in giving care to such of their personnel who needed it. The 10th Field Ambulance had close association with the American medical services, and treated and held American patients at forward posts at Sanananda, and at Popondetta airstrip. Similarly the American portable hospitals in the Buna area held and treated some Australians, and the 2nd United States Field Hospital was part of the Australian line of evacuation from the 10th Australian Ambulance M.D.S. to Dobodura. Assistance was always cheerfully given; supplies of material such as dried plasma were obtained from the Americans, who also helped in transport of wounded if necessary, and shared the carrier trains with the Australians with perfect fairness.

Wastage by illness. Sickness, apart from battle wounds, was of great importance to the forces on the coastal plains. We have seen how dysentery became not only a menace on the Owen Stanley Range but an active agent in seriously lessening the strength and endurance of the men, and was only countered by such vigorous measures of hygiene as could be established and maintained over that long and fantastic line of communication, and by the use of sulphaguanidine in the aid posts. Malaria was then only of secondary importance, but the descent to Kokoda re-introduced this subtle enemy, and by the time the troops had gathered on the plains the danger was apparent. The actual wastage by illness, in particular malaria, was very great. During the action periods the fighting forces were seriously reduced by this ruthless enemy, and the need for keeping all possible men in the fighting force compelled medical officers to keep many who were not fit. A previous experience had thinned the fighting forces in Milne Bay, but there the campaign had been brief, and the full lesson of prophylaxis had to be learnt afterwards. These two experiences may now be reviewed with advantage, for out of them arose decisions and action which were of the first importance in establishing sound anti-malarial measures in military forces engaged in highly malarious regions.

CHAPTER 7

MALARIAL AFTERMATH

(a) MILNE BAY AFTER THE ACTION

THE history of Milne Force after its aggressive defence action against the Japanese, and its military commitments are significant in relation to its malarial experiences. The successful conclusion to the action at Milne Bay did not lift the menace of malaria from the troops in the area. The building of a safe defence organisation was essential, and this could not be done without learning to adapt the pattern of living as a military formation to an equally sound hygienic organisation. In this self-contained place these problems were worked out. One battle had been won against the Japanese; another was nearly lost, against the malarial plasmodium and its vector. Milne Bay provided a classic lesson in malaria prevention, and though an exactly similar situation was never repeated during the war, the lesson remained for the instruction of those who would learn from its practical demonstration of the causes and prevention of epidemic malaria.

The cessation of organised resistance by the Japanese allowed the defending forces a breathing space. At least there was no military enemy to contend with at the moment, but there was still the hostility of nature.

MEDICAL ARRANGEMENTS

In the medical planning for Milne Bay there had of necessity been some extemporisation, but there had also been some discussion about the most practical type of medical unit to use as a hospital in the area. Though a field ambulance can act as a holding unit, it is only a temporary expedient, yet there were logistic difficulties in bringing in a general hospital or a C.C.S. with their added weight of equipment. Even a 200-bed hospital would soon have to expand to hold 500 to 600 patients. Nevertheless the decision to move the 2/1st C.C.S. to Milne Bay was wise, in spite of local difficulties, though it was agreed that the time was not apt for bringing in female nurses.

On the 8th September Lieut-Colonel R. J. Stabback and the staff of the 2/1st C.C.S. had to land their gear and stores in implacable weather, when vehicles were bogged along the roads and all but the higher ground was flooded. Specially made cases protected some of their contents, but not all, and a week passed before tentage and other material could be brought to the unit's temporary site in a rubber plantation. Even then it was hard to keep stores dry; other units had found that when mud was used to camouflage tents moulds were introduced, causing rapid deterioration of the canvas with consequent leakage. Moulds also caused mosquito nets to rot, so that the fabric tore easily, and the nets soon became useless. On the 21st, 210 beds were equipped and 175 occupied,

but two orderlies already had malaria. Much of the equipment was still in an inaccessible dump three miles away; this increased difficulties, especially as the bed state soon rose to 200 patients. By the end of the month more of the staff were going down with malaria and flood rains again inundated the low-lying part of the camp.

The 110th C.C.S. was still working on a temporary site, and needed a brief period of relief in which the unit could move to its correct location. The A.D.M.S., Colonel Maitland, therefore intended to substitute the 2/1st C.C.S. for the 110th while this change was made. This could not easily be done, for the rush of battle casualties was being more than replaced by a spate of illness, chiefly malaria. The strain on the forward companies of the 11th and 2/5th Field Ambulances was at least partly lifted, and the A.D.S. at Gili Gili was able to move west of the Hagita ford, when the 18th Brigade also moved back in reserve. The work of Major J. J. Ryan of the 11th Field Ambulance and Major Lavarack of the 2/5th Field Ambulance was specially commended by the A.D.M.S. Maitland himself had worked under great difficulties, being without a deputy until the end of August, when Whiting was sent to act temporarily, until later replaced by Major J. R. Magarey.

There was a great shortage of staff officers in the A.A.M.C. at this time; in fact Major-General S. R. Burston had pointed out that too many requests were made for officers to fill such posts as D.A.D.M.S. of the new areas and sub-areas that were coming into being with the expansion and dispersion of the Australian Army. Some of these requests simply could not be granted, though this in no way applied to Milne Bay. At first Maitland had no office facilities; practicable transport was sometimes lacking and personal inspection and supervision were hard to maintain.

The 110th C.C.S. was able on the 15th to transfer eighty patients to the M.D.Ss. in the Waigani area, but a few days later, though the weather was fine, the roads to both ambulance units and to the 2/1st C.C.S. were closed to traffic. Figures showed that 1,462 cases of malaria had passed through the medical units since the arrival of the force, and when the D.D.M.S., Brigadier Johnston, revisited Milne Bay on the 23rd he agreed that many of these men needed help towards convalescence rather than hospital attention. A convalescent depot had become a necessity.

Fortunately, though malignant tertian was the prevailing type of malaria, most attacks were mild owing probably to the use of suppressive quinine; nevertheless another death (the second) had occurred from cerebral malaria. One-sixth of the force had contracted malaria within two months. Now that the tension of action was lessened the sense of personal responsibility was slackening; the members of the force were even less malaria-conscious. A local shortage of quinine, atebrin and plasmoquine caused some passing worry at this time: promised supplies lagged, in spite of confirmatory signals from Moresby, but the much wanted quinine arrived just in time to maintain suppression in the force. There were still grave shortages of anti-malarial equipment.

Necessary engineering work was to be carried out, particularly on the site selected for a convalescent depot on the eastern side of the Maiwara River, and on the road of access to the new site of the 110th C.C.S. There was still a present danger of such work increasing the possible breeding grounds for mosquitoes. As the rainfall abated these hazards actually increased. Further, gametocytes, the transmissible sexual stage of the parasite, were rapidly forming a "pool", both in the native labour force, which was making contacts with the soldiers in greater numbers, and in the blood of the soldiers themselves. As malarial diagnosis became more exact with growing facilities and experience, so the true position became more evident. The unidentified pyrexias, and the cases of alleged dengue fever were in truth malaria. Captain A. K. Sewell of the 110th C.C.S. had established a small laboratory and found that using the technique of thick films with Field's stain, parasites could be demonstrated in half the cases submitted, and in 70 to 80 per cent of those in which malaria was suspected. By contrast, another unit using thin films only, could find parasites in 10 per cent of cases of fever.

Unit malaria squads were formed, and arrangements were made for these to be trained by the 8th Australian Malarial Control Unit. Captain F. H. S. Roberts of the 1st Mobile Entomological Unit arrived to help Captain S. L. W. Allman in the work being done by his 8th A.M.C.U. Allman drew up a list of measures suggested for immediate application as part of the planning for malaria control. This stated that survey of the area had shown that anophelines bred freely within unit lines in semi-permanent collections of water, particularly slit trenches and old wheel tracks. All these needed treatment with sump oil. Filling in all unused tracks and instituting a consistent track discipline were also advised. Drains were to be kept free, trenches sprayed daily as well as tents, and protective clothing worn to reduce risk of infection. Maitland reported to the commander of Milne Force that the malarial figures were too high, and that breaches of instructions were occurring. These included non-use of nets, the failure to wear slacks and gaiters and to roll the shirt sleeves down after sunset. The missing malaria pamphlets at last arrived from Moresby and were welcomed as part of the campaign.

The general problem of hygiene was worrying in Milne Bay. The action against the Japanese had come at a time when the units barely had time to scramble to their locations, and the physical difficulties of the area were great. Sanitation offered problems; latrines constructed on low ground could not be deepened sufficiently without running into the water table, and were readily swamped. Water supplies were liable to pollution, and though there had been only a few cases of mild dysentery, an outbreak was possible. The supplies of chlorinating chemicals were deficient, and no sodium thiosulphate had been obtained for detasting. In consequence the super-chlorinated water was so unpalatable that the men would not drink it. Individual outfits for water-bottles were not available, nor were there any clarifying filters. The A.D.M.S. pointed out that the risks of pollution of water would be greater as the wet season

receded. He was also perturbed that changes incident on the complete reorganisation of the hygiene system of the army had come just at this time of shortages of men and material. Captain G. H. McQueen had arrived to take up the post of D.A.D.H. on 6th September, but no hygiene personnel had been appointed for attachment to units in the 18th Brigade, or to the other services. Maitland had to fill the gap by appointing men outside the brigade to be used in this capacity. Moreover, no provision had been made for a constructional section, such as was previously so useful in a field hygiene section for making and advising on sanitary appliances. Later, when the rain eased, central water points were set up, and the clearer water needed only a small amount of chlorine without detasting.

Nutrition was given some consideration. Naturally during the previous month or so most food came out of tins, and Maitland applied for tablets of ascorbic acid for general use.

During September scrub (mite-borne) typhus appeared in the force. At the beginning of the month, and perhaps earlier, this infection was suspected, and by the middle of the month its clinical identity was established. It is interesting that both in Milne Bay and Moresby scrub typhus was independently recognised as occurring at the same time. Serological tests in both areas established the identity of this rickettsial infection without doubt, as the blood serum agglutinated *B. proteus OXK*. On the 20th when there were 759 patients in medical units in Milne Bay forty of these had typhus. In all, 103 cases of scrub typhus were treated in the 110th C.C.S. in Milne Bay with only one death.

Milne Bay was well served by dental officers, and following the visit of the A.D.M.S. (Dental) New Guinea Force to the area on the 16th, Major H. S. Sullivan was appointed as D.A.D.M.S. (Dental), and set up in Hagita House; one dental unit acted as a mobile dental centre, so that the battalions might be visited in turn, and work be done there as well as on the patients passing through medical units.

During October the position regarding malaria showed no improvement. The military strength was increasing, particularly when the 17th Brigade brought in its advance groups, followed by its other components. The average strength of Milne Force rose from 10,617 in September to 13,296 in October, and the numbers were then still rising. But there was no decrease in the numbers of sick, although there was no appreciable wastage from battle casualties. The menace of the Japanese had virtually disappeared in the Milne Bay area. At several outposts on the north coast Australian forces were maintained, but these were not involved in major actions. It seemed that the present issue with the enemy was to be decided in the coastal plains behind Buna and Gona, and that the forces in Milne Bay would be sufficient to keep it safe from further invasion. The outposts were subject to the same hazards of disease as Milne Bay itself, but they constituted no serious problem as their numbers were low. Milne Bay was, however, of strategic importance, and it was in danger of losing its garrison from malaria. There was little dysentery there; typhus was not

severe or serious, and most of the patients were sent away if possible. Evacuations to the mainland approached the equivalent of two battalions a month, and there were good reasons for believing that the majority of Milne Force was infected with malaria, M.T. or B.T. or both.

A disturbing feature of the sick rates in Milne Force was the high proportion of members of the A.A.M.C. who were ill; admittedly their work exposed them to infection, especially at night, but this increased the already embarrassing shortages of medical officers and orderlies. Still more disturbing was the observation that medical units which previously had a reasonably low malarial rate were beginning to show a definite rise.

On the 27th the 2/2nd Field Ambulance arrived at Milne Bay under command of Lieut-Colonel R. S. Smibert, and in pursuance of its function with the 17th Brigade, began to establish an M.D.S. with its "B" Company and an advanced station with its "A" Company. The M.D.S. was established in tents slung over poles bolted to trees, and proved airy and capacious. Smibert's staff had experiences similar to those of others. Malaria attacked members of the unit; one orderly who had omitted to take suppressive quinine during the first week contracted malaria after eleven days in the area. The opportunity was taken to send some orderlies to relieve in the 110th C.C.S., where they gained valuable experience. A medical officer was also detailed to the north-eastern posts at Wedau and Taupota.

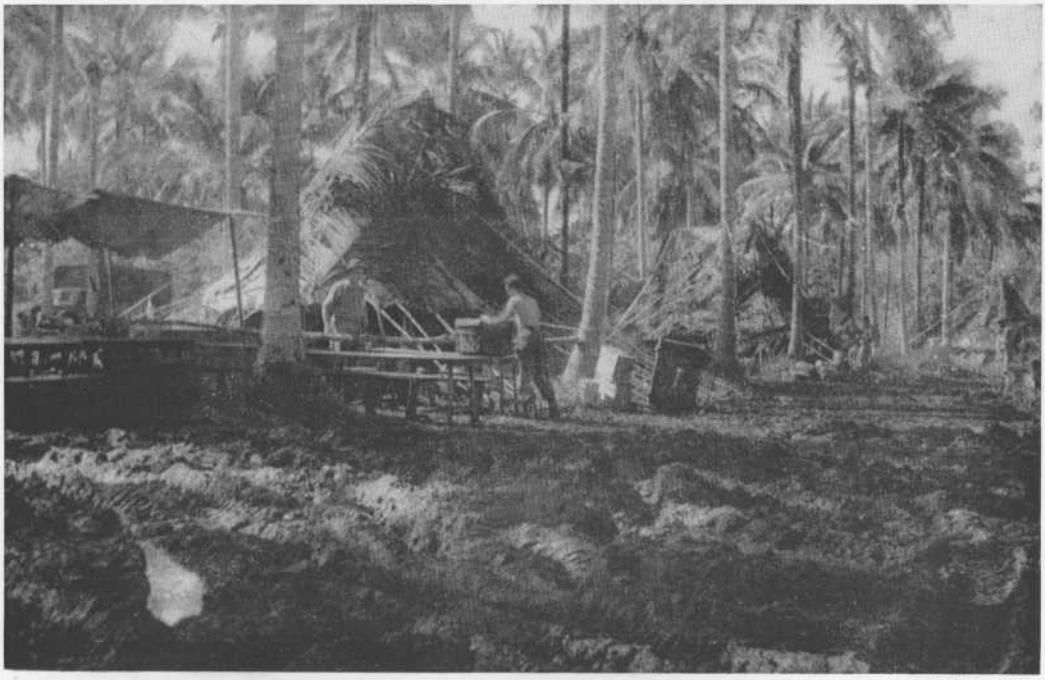
Medical officers at once began to study malarial diagnosis in the laboratory of the 110th C.C.S. which relinquished its old site on the 14th. Using E.P.I.P. tents and marquees Wall's unit was soon in full swing again, and on the 21st had 274 in hospital. By the end of the month difficulties with the uncompleted road to the site and with water supplies had partly been overcome, and more native huts were being built to accommodate the growing numbers, which reached 321 by the end of October. The 2/1st C.C.S. was still receiving a few casualties from outposts; one was found to have gas gangrene. Troubles with water were still being experienced: Stabback's unit actually built a dam to conserve water from the neighbouring creek, but the dam gave way and all the water was lost.

In anticipation of the opening of the convalescent depot, and to obviate the loss of too many men to the mainland, the numbers sent from the C.C.Ss. by hospital ship were lessened; this rather increased the strain on the units in Milne Bay. From the malarial as well as from the military point of view Milne Bay was mainly a self-contained community. It is therefore interesting to study the rapid rise in malarial incidence which is evident in the accompanying graph. The first indications of an acute outbreak have been described in general terms, and were seen in September and October, but the next month showed that rapid rise to a sharp peak so highly characteristic of the epidemic form of malaria. In this were combined many causes, little-controlled anopheline breeding, rapid increase in adult mosquito population, propinquity and increase of a "pool" of gametocytes in natives and soldiers, inadequate suppression, and



(Colonel F. L. Wall)

The staging camp of the 110th C.C.S. at Gili Gili



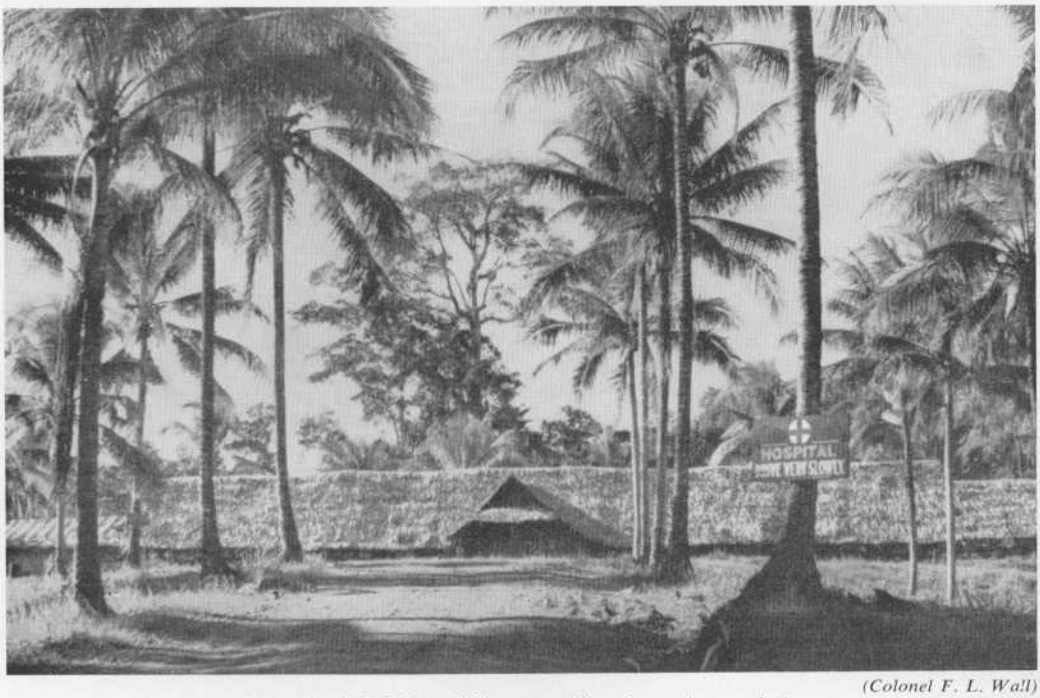
(Colonel F. L. Wall)

The 110th C.C.S. at Milne Bay during the action period.



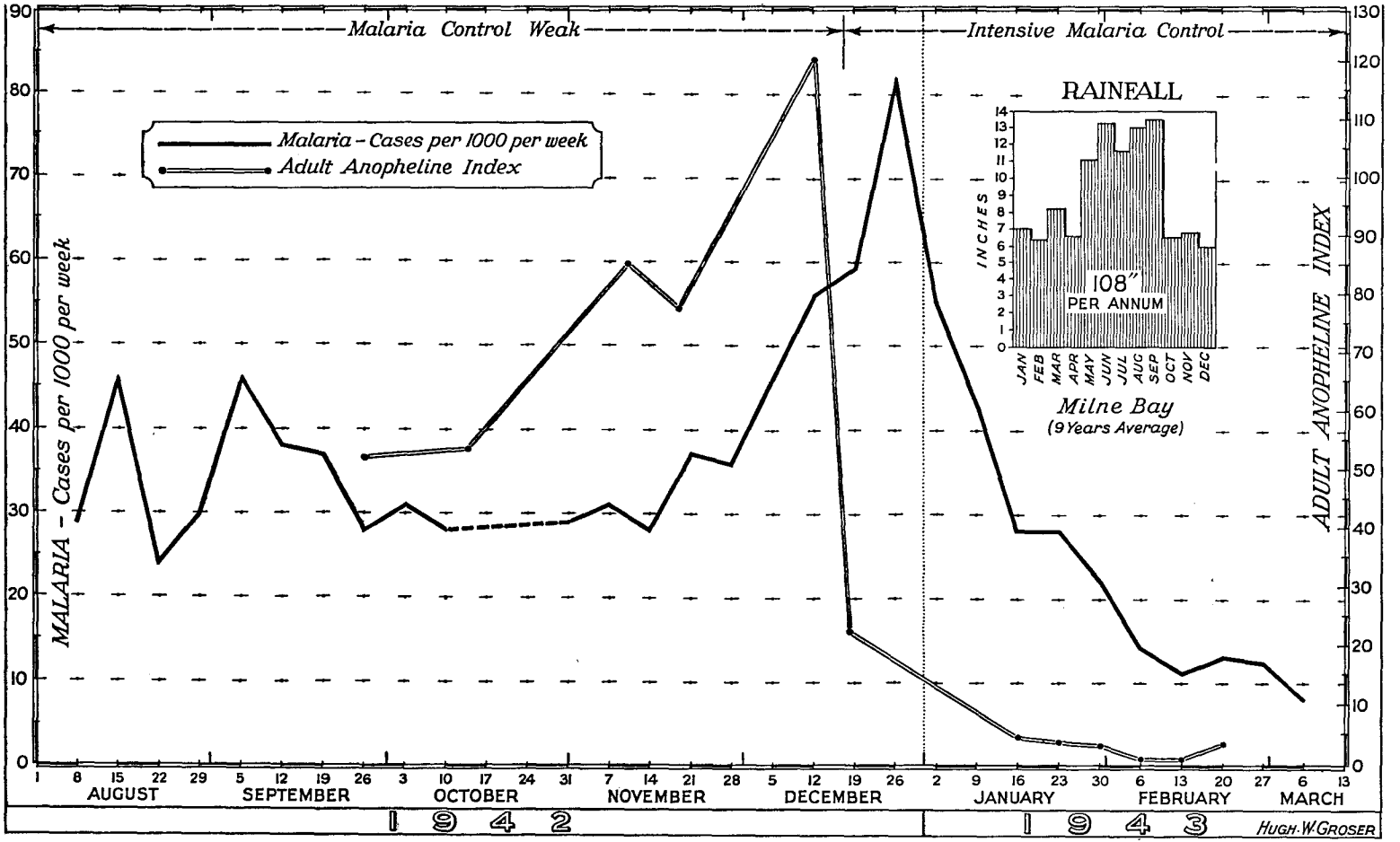
(Colonel F. L. Wall)

Malaria control Milne Bay.



(Colonel F. L. Wall)

The 110th C.C.S. at Milne Bay after the action period.



Milne Bay: malaria in 1942-1943

inadequate personal protection. Even in the base hospitals in Australia enquiry among patients showed that control needed to be tightened in endemic areas. The D.G.M.S. reported that consulting physicians had obtained evidence from patients transferred from New Guinea that anti-malarial precautions were being poorly implemented by combatant officers. This applied to Milne Bay as well as to other areas, though in justice it must be remembered that adequate anti-malarial supplies had not yet reached that area, a riddle not yet solved.

ADVANCES IN MALARIA CONTROL

It was evident to experienced administrators that measures of several kinds were needed; those designed to secure regular supply of material and stores for anti-malarial work, the provision of manpower for essential work and the establishment and maintenance of a discipline which springs from a true conviction of its need and importance. An important step was taken when Major R. C. Townley was sent from Land Headquarters in Melbourne to investigate questions of supply. The establishment of a properly constituted advanced depot of medical stores was needed in order to remove most of existing local difficulties, and once a flow of materials was assured these troubles were adjusted. Townley investigated the cause of delays on the mainland and found that indented stores had arrived in Townsville, but these were stowed in sheds where they were discovered only after several months. Faulty handling by movement control and docks' operating units, and lack of sufficient precautions in marking had caused this delay. Improved methods were introduced, and direct indents from Milne Force to Land Headquarters were advised.

On the scientific side administrative improvements in the malaria control units increased the efficiency with which preventive methods were applied, and the creation of entomological sections was followed by the setting up of a directorate of entomology under Mackerras, who had been in charge of entomological work at Land Headquarters since May 1942. He was sent to Milne Bay to make special investigations and to supervise the entomological side of the work.

Administrative assistance was given to the force by the coordinating work of the Advanced Land Headquarters at Brisbane, where the A.D.M.S. was Colonel A. L. Dawkins. Evacuations of the sick and allotment and delivery of supplies were accelerated by the Combined Operational Service Command, to which Lieut-Colonel Macdonald as A.D.M.S. was the Australian medical representative.

Brigadier Johnston next took the direct step of enlisting the personal help of the Commander-in-Chief. Lieut-Colonel Ford, the Assistant Director of Pathology to New Guinea Force, a highly experienced malariologist, though not yet officially appointed as such, interviewed General Blamey at the beginning of December, and placed the position before him. Blamey not only showed sympathetic interest in this appeal, but also ordered an official report of the interview to be prepared and took immediate action on certain vital matters.

The main points in this discussion were concisely stated in the war diary of the D.D.M.S. New Guinea Force for 4th December:

(a) That there was no deep consciousness in the force that malaria could destroy it as a fighting body and bring disaster to its operations. It was basically necessary that this should be understood by all ranks.
(b) That the malaria discipline was bad, and imperilled the success of our arms.
(c) That it was necessary that officers should realise their responsibility in regard to malaria discipline, and the order should be observed in every detail. No officer was fit to command in a hyperendemic malarial area who did not realise the menace of malaria, and take every step to combat it.
(d) The importance of personal protection was stressed as the most important means of malarial prevention in the field, and defaults and omissions in carrying out the orders in regard to this were quoted.
(e) Suppressive quinine treatment—its importance in maintaining troops in the field and the necessity for care and speed in distribution, necessity for priority in transport and anti-malarial drugs.
(f) Preparation of troops for tropical service—supply of mosquito nets before embarkation—important to be able to commence protective measures immediately on arrival.
(g) The alarming position as regards casualties at Milne Bay, and the steps considered necessary to overcome it, were discussed.

Ford emphasised that malaria could destroy our force as an effective instrument and that as the heavily malarious areas recently occupied by our soldiers were characteristic of many in Melanesia, these should be vital training grounds where they could learn how to fight in the tropics in relative safety. Nets should be available to them immediately they arrived in endemic areas, and their use ensured.

In Milne Bay anophelines were breeding over forty square miles of the area; engineering work was urgently needed for drainage and elimination of breeding grounds. Most of the malaria control unit's material was not yet to hand several months after the arrival of the unit; there was pressing need for this, and also for more assistance from unit squads and malaria control units, and from the personal collaboration of an engineer and an entomologist. At least 1,000 men were needed to make Milne Bay safe, and adequate supplies of nets, sprays and other requisites were wanted urgently. This reasoned appeal produced immediate action by direction of Blamey.

Native labour was made available, and 500 men were immediately set to work on drainage and similar work. In the middle of December Captain C. Brasher arrived with the 2/2nd Malaria Control Unit, and following up Townley's investigations, made a special visit to the mainland and was successful in bringing back a plane load of anti-malarial material. This was promptly put to use under expert supervision. At the same time the 17th Brigade was moved to Moresby, preparatory to attachment to Kanga Force; this relieved the pressure on medical units in Milne Bay.

Some weeks passed before the full effect of adequate and generally applied anti-malarial measures was felt, but this period was a crucial one in the fight against malaria in Milne Bay. During the month of December

the strain on the 2/1st C.C.S. was somewhat eased by the transfer of 255 patients to the mainland by sea ambulance transport. Half of the staff of this unit had already contracted malaria, and though badly needed reinforcements arrived during the month, on the 22nd, 533 beds were occupied in the 2/1st C.C.S.

The opening of the convalescent depot in the Waigani area was a measure of great value. It had been observed that the incidence of tropical diseases, in particular malaria, was greater among the 7th Brigade; this was believed to be related to the greater time the formation had been in Milne Bay, exposing its men to greater risk of infection and to greater fatigue. The convalescent depot provided an opportunity for rehabilitation for such men, and before long it was accommodating 300 men under command of Lieut-Colonel K. C. Purnell, until through illness he was followed by Lieut-Colonel J. N. Freedman. An unusual feature of the programme laid down for the patients was the organisation of trips on luggers into the China Strait. This helped to make the men interested and self-reliant and proved popular and valuable.

It was unfortunate, though illustrative of the risks of a hyperendemic area, that the D.A.D.M.S., the A.D.M.S. and the G.O.C. all fell victim to malaria about this time. At the end of December the malarial incidence rate, which had reached 33 per 1,000 per week in September (1,716 per 1,000 per year) rose to 82 per 1,000 per week (4,264 per 1,000 per year): at this rate the force would have fallen to zero in three months. During the third week of December 1,083 out of 12,000 men contracted malaria. The strain of dealing with this number of sick was intensified by the growing unfitness of the force.

A further serious consideration was the bad effect of the steady drift of men to the mainland. Clowes had stated that infection by malaria should be regarded as a self-inflicted wound, but at that time the capacity of malignant tertian malaria to break through suppression by quinine was not as clearly recognised as it was later. Even conscientious commanders were not proof against this risk. Yet in the last few months of 1942 malaria was coming to be regarded with an air of inevitability by the force in Milne Bay, a feeling that could not be dispelled even by the energy and optimism of the senior officers, among whom should be specially mentioned Colonel Maitland. One medical commander noted the feeling of claustrophobia engendered by the dullness of low-thatched native hut wards and the gloom of rubber plantations beneath a leaden sky. It was fortunate that the brief campaign had come so early, otherwise the saturation of the force by malaria would have been a serious drawback to the success of those sharp conflicts which turned back the Japanese.

The effect of Blamey's authority was soon felt. The over-night appearance of a growing labour force, the clearing up of the hitherto obscure delays in supplies, the provision of a special officer to speed on these vital items to their destination and the emphasis laid on personal responsibility of all ranks brought about welcome changes. Of great importance too was the recognition of the principle that patients suffering from malaria

should be as far as possible retained for treatment in New Guinea, and not sent back to Australia.

But the corner was turned in December and vigorous measures, supplemented early in 1943 by the substitution of the more effective suppressive atebrin for quinine, produced good results. This statement needs some qualification, for supplies of suppressive drugs were still restricted, and the troops stopped taking quinine and started on atebrin without a "lap-over" period in which the atebrin could have built up an efficient blood level. Some immediate increase in malaria was observed at first: had this occurred at a less quiet period the malarial incidence might have shown more rise than it did. Further the men temporarily lost faith in the new suppressive until its protective power was later evident. In addition, the initial dosage of 0.6 gramme weekly, then regarded as adequate, could have been higher at first with advantage.

The anopheline index of the area fell sharply as larval and adult control of the vector reduced the mosquito population, and a corresponding sharp fall occurred in the clinical incidence of the disease. It was also an advantage to have the relatively dry season in which to establish roads and carry out other engineering projects. The incidence of malaria among the air force also declined sharply, though its members had the disadvantage of not having an adequate supply of protective clothing. Mackerras in a report on the entomological and epidemiological aspects of Milne Bay, found that the prompt reduction in malaria was undoubtedly directly related to the control of vectors. Other measures which were effective were the use of gametocidal drugs, in particular plasmoquine, the segregation of native labour forces, carriers of gametocytes, and the retention in New Guinea of men under treatment for malaria as far as this was possible and advisable.

RELIEF OF MILNE FORCE

The time had now come to substitute other troops for those who had been in Milne Bay for some time and were showing obvious fatigue. Therefore, during January, Milne Force was relieved by the 5th Division, under command of Major-General E. J. Milford and with Colonel S. H. Lovell as A.D.M.S. The advantage of a new force taking up the tasks was great, especially as the 5th Division had had experience of a local epidemic of B.T. malaria in Cairns, and was well-trained in preventive methods. It should be clearly realised that the effects of control put into operation by Milne Force became evident by definite improvement in the malarial position before the force was relieved by the 5th Division. The changeover came at an auspicious time, and full advantage of this was taken by the fresh formation in pressing on with all effective control measures. The results were striking. Within a month the infection rate had fallen from thirty per week to ten per week, and it fell still further. The subsequent medical history of Milne Bay was satisfactory. Like all hyperendemic areas, it produced a certain incidence of malaria in spite of all precautions, but after control was established this was never immoderate.

In March, arrangements with Angau made it possible for all natives in working parties in the military area to be transported each evening to a prepared native village, Baraga. This prevented dangerous contacts of vector and carrier and lowered the sporozoite rate of anophelines of the area. A difficulty arose in the siting of a convalescent depot, which was too close to Baraga for safety, but another site was chosen. The malarial rate in March was 8.2 per 1,000 per week; this fell to 3.8 per 1,000 per week during the next month, and for a short period in June was as low as 1 per 1,000. In July the 5th Division was moved to Moresby for other duties in the Salamaua campaign.

There is no doubt that the fresh 5th Division seized an opportunity in applying all the recognised methods of malaria prevention practicable to a force in the field, and set an excellent example, which had still to be supplemented by the attainment of comparable results by a force in action. This highly successful experiment in malaria control was backed by authority at all levels; it was well designed, as it attacked all biological phases of the malarial parasite, from breeding to transmission from the carrier. The first essential step was destruction of the vector mosquito, and immediately after the term of incubation in the human subject was completed the dramatic fall in clinical incidence began. The introduction of atebrin as a suppressive was coincidental with other events in Milne Bay, but the superior suppressive power of atebrin over quinine exerted its effect with growing force from January 1943, when the change began, to March when it was complete.

Another forward step was the official appointment of three malariologists to the Australian Army. In March Lieut-Colonel Ford and Majors J. C. English and F. J. Fenner were appointed in this capacity. Between them they were able to bring a combination of experience in military hygiene, scientific knowledge of pathology and parasitology, and of first-hand experience of work on malaria in the field, and their official status raised the standard of anti-malarial work. The introduction of a new repellent, dimethyl phthalate ("Mary") must also be mentioned, as this was an important advance in the technique of personal protection.

During the succeeding quarters of 1943 there was really little difference between Milne Bay and any other tropical area where malaria flourished but could be controlled. As the war centre shifted north and east, Milne Bay became less important to the army, but it continued to be a bastion of defence and was used by all three Services at later periods.

The general hygienic standard of Milne Bay remained satisfactory once the necessary control was maintained. Early in 1943 English reported on the hygienic standard of Milne Bay. Water supply had given some anxiety, but when men and materials were available no trouble was encountered. One case of typhoid fever occurred among men who had been neglecting chlorination of water. Dysentery showed only a low incidence, 0.45 per 1,000 per week; throughout the whole period it was not a serious danger. English found only a few rubbish dumps in the area and pointed out that the best remedy for this breach of rules was to

make an incriminated unit bury the entire dump. The food was good, and included a good white bread made by the local bakery, though a wholemeal loaf would have pleased the nutritional experts more. Reserve rations were for a time held in excessive amount; this resulted in deterioration, but the defect was avoidable. Adequate refrigeration space was available. General anti-malarial discipline was then good in the area, in fact the only weak spot was that spraying of messes was often neglected.

The transformation of a dangerous area to a relatively safe one was virtually complete, except for that constant supervision which is imperative, and indeed is part of a good organisation. In the beginning there were immense difficulties in the way of applying preventive measures with any consistency, but the outcome showed that the problems could finally be solved.

GOODENOUGH ISLAND

Goodenough Island lies seventy miles north-east of Milne Bay and has features similar to other parts of Papua, with mountainous areas, especially to the north-west, and undulating plains with forest and kunai grass intersected by rivers.

The Japanese invasion convoy to Milne Bay, leaving Rabaul on 24th August, included some 200 of a marines unit, the remainder of whom had previously landed at Buna and were now planned to move round the coast in landing craft to Taupota, and thence to march on Gili Gili. Next morning the Buna detachment was seen landing on Goodenough Island, and as soon as the bad weather cleared, the R.A.A.F. attacked and destroyed their barges. Here this section of the invasion force was left stranded on Goodenough, maintained by submarine, until 22nd October when the 2/12th Battalion landed on the island with the task of expelling them and preventing further occupation.

The operation was planned so that one company would attack from Taleba Bay, and the remainder of the battalion would attack from Mud Bay. Both assaults were delivered on the night of 22nd-23rd October and, although they were not successful in driving back the Japanese, the enemy withdrew during the night of 24th-25th and left the island. The resemblance of these tactics to those employed by the Japanese at Milne Bay will be noted. Once in possession, the battalion carried out an elaborate simulation of an active and considerable occupation force.

During the brief period of action there were twenty-seven battle casualties, including thirteen men who were killed. The system of medical evacuation was by water. Ketches made the trip between Goodenough Island and Milne Bay and transported sick and wounded after initial treatment in an aid post. Among the casualties in Drakeforce, as the battalion group was called, there was one case of gas gangrene. Malaria and typhus both occurred on the island: patients needing hospital care were sent to Milne Bay by the same sea route, and occasionally by air if opportunity offered.

Early in 1943 the installations on Goodenough Island were considerably extended, but also were widely dispersed to give the impression from

the air that the island was strongly held. The buildings and tracks were tactically disposed, therefore when the site for a camp dressing station of 125 beds was to be chosen for "B" Company of the 4th Field Ambulance, care was taken to fulfil these requirements. Medical care of Drakeforce on Goodenough Island was carried out by Captain G. A. Goding, R.M.O. of the 47th Infantry Battalion, at the aid post, and further treatment was given at the ambulance dressing station. The R.A.A.F. also had medical facilities on the island.

(b) THE BUNA AREA

The satisfactory conclusion reached by combined effort in Milne Bay could not be duplicated on the coastal plains of the north coast of Papua, for conditions were entirely different. The country and climate in each area suited the infective agent of malaria well, likewise its insect vector, and transmission of the disease was thus maintained at a high level in both places. But there were essential differences. The devastating epidemic struck Milne Bay at a time when the immediate menace of attack had been removed or at least much reduced, whereas a bitter struggle ensued for Buna and Sanananda even after Gona had fallen. Moreover, the delimited area of Milne Bay presented problems quite different from those of the coastal swamps, which were all the more treacherous because the troops approached them from high ground, virtually safe from malaria. We have seen how the suspension of suppressive quinine, and the subsequent mishaps of non-receipt and non-distribution of supplies started the troops downhill from Kokoda in more ways than one. Further, the men on the plains had been through exhausting experiences and their resistance flagged.

As the troops reached the coastal plains the prevalence of malaria was soon evident. It is true that from the point of exact diagnosis the precise incidence of malaria could not be ascertained at the time, for even if the facilities for pathological examination were present, there was frequently no time for its application. Of the short-term pyrexias dengue fever was considered the most probable if the specific vector was present in the area, but, as was found in Milne Bay, the fallacy in this diagnosis was often revealed by subsequent blood examination or by the occurrence of malarial relapses. As most of the primary malaria was of the malignant tertian type, adequate treatment usually cured it without permitting relapse, but if relapse occurred, it was rather of the nature of recurrence, and any subsequent attacks were found to be due to benign tertian fever breaking through. Medical units soon became aware that many of their members were suffering from malaria. Occasionally it was possible for them to carry on with a brief intermission from work during which they were given a routine course of treatment. These workers were especially prone to contract infection by exposure to the mosquito during the night hours.

At the end of December quinine ceased to be the officially approved suppressive drug, and atebrin took its place, but the troops involved in

active operations in most instances continued to take quinine until their relief. The high incidence of malaria, which continued till the end of the Sanananda campaign, was not solely related to the particular suppressive used, though had atebrin been persistently taken, the prevalence of overt malaria should have decreased within a short time.

The increasing size of New Guinea Force and the greater numbers of fresh formations brought in to end this expensive and difficult campaign demanded more hospital care. Ever since the 2/9th A.G.H. had been opened in Moresby during September the call for beds had increased. This hospital grew to 2,000 beds, and in addition the 5th C.C.S. had been working in the area since May and the 2/2nd C.C.S. at Koitaki since November. Yet at the end of December Brigadier Disher stated in his diary that: "Medical units are swamped with malaria, and I have just discovered that hospitals *et cetera* are discharging them to units to complete treatment with plasmoquine." He further remarked that he thought that 100 per cent of the men at Milne Bay and in the Buna area had been infected. The only consolation was that the constant diminution of the forces from malaria was helping considerably to a more realistic view of the position. In January the 2/5th A.G.H. was brought to Moresby, and within a month was taking patients; also the 2/1st Field Ambulance, which for a time ran an A.D.S. in the lower Moresby area, and was engaged in other various tasks, had also established a series of medical wards holding 400 patients in what was virtually a malaria hospital. The 3rd Field Ambulance was discharging a like function, and holding some 600 patients, many with malaria. Evacuation to the mainland was a possible means of relief, but not one in accordance with military policy, for since Blamey's ruling on this important question, all efforts had been made to keep men in New Guinea who were considered fit to return to duty after a course of treatment for malaria.

The Atherton camps were now in working order, and debilitated troops were being transferred there for rehabilitation.

But, though the end of the Sanananda campaign was in sight in January 1943 the flood of malaria was not stayed, and the losses were serious. The bed state in medical units of New Guinea Force on 24th December had reached the high figure of 3,570, excluding 1,021 in the convalescent depot, and a further number in Milne Bay, which was in a sense self-contained. The daily admissions were seldom under 200. Hospital ships and aircraft returning to Australia supplied some of the demand for transport to the mainland, but more planes and ships were needed.

A month later when Sanananda had fallen, and only "mopping up" operations remained, figures showed that the casualties among the Australian and American troops in Papua were as follows:

Troops	Tropical Diseases	Malaria	Battle Casualties
Australian . .	29,101	21,600	6,154
American . .	8,259	6,292	1,598
Total . . .	37,360	27,892	7,752

It will be seen that tropical diseases gave a ratio of 4.8 to 1 to battle casualties. For malaria alone the ratio was 3.6 to 1. These figures are definitely understated, as they take no account of many men who had latent malaria which only became manifest on return to the mainland and on cessation of suppression. Further, numbers of others kept on their feet and were not recorded as hospital admissions, though they received treatment. In early December Hobson had his M.D.S. at Soputa occupied to the last available shelter, with 200 battle casualties admitted in twenty-four hours, yet the sick rate among the 2/4th Ambulance staff, and the attached 2/6th Ambulance staff was so high that on occasion only forty-two men from these units were able to work. A week later, out of a total strength of seven officers and seventy-six men of the 2/4th Ambulance, three officers and thirty-seven men were being treated for proven malaria. Such instances could be paralleled in other units exposed to the full risk of malarial infection, and the visible shrinking of the fighting forces illustrated the same lesson.

As malignant and benign tertian types coexisted in the hyperendemic areas of New Guinea, overt malaria, when it appeared in men only partly protected by a suppressive drug, was usually of the M.T. type. If due precautions were not taken M.T. might assume an epidemic form. B.T. of course also occurred in acute attacks or with M.T. in a mixed infection. The true position with regard to mixed infections was often only revealed by the subsequent appearance of B.T., especially when treatment was suspended in men being rehabilitated in a safe area. There is little wonder that the troops transferred to the Atherton Tableland showed so high a percentage of B.T. malaria, or that this malarial wastage of men continued for months afterwards. There was good reason for admitting that the infection rate in the northern coastal plains must have been approaching the maximum possible. Later, in August 1943, it was estimated that 20,000 individual members of the Australian Military Forces had been affected by malaria since 1st January 1942. The number of hospital admissions totalled 58,358; this figure of course, includes relapses, and it appeared that the average number of relapses per man was two, though it varied greatly and even reached eleven in some individuals. The ultimate result of treatment was good, for 90 per cent of 3,056 men treated on the Atherton Tableland were returned completely fit to their units. The controlled areas did not yield many cases of malaria by comparison. Practically all malaria treated in Australia was contracted in New Guinea. The static areas in New Guinea, Moresby in particular, were well controlled. First attack rates in the Moresby base were not as low as desirable, and reached 5 per cent per annum, but the first attack rate for all New Guinea, including the forward areas, was 13 per cent.

The suppressive drug used over most of the period was quinine; although atebrin was introduced as the official suppressive at the end of December 1942 the actual change to atebrin was made only gradually as troops involved could not be so readily supplied or instructed. The 18th Brigade, for example, went into action in mid-December, but did not change to

atebrin until their withdrawal from action on 11th to 14th February. An investigation of these men was made at the rest camp at Donadabu when they returned from the northern plains. Some 1,300 men of this brigade who were examined by Major A. A. Ferris were also investigated so as to determine their length of service in New Guinea, and the parts in which they had been. The state of the spleen was ascertained and their blood was examined by Field's stain on thick films to find if trophozoites and gametocytes were present. Some high rates were found in certain of these groups: for example, 29 per cent of one group of men who had been only at Buna showed parasites in the blood, and 18 per cent had gametocytes, in other words, transmissible forms. After five weeks in the Buna-Sanananda area 7.3 per cent of men who had an attack of malaria still showed parasites in their blood, as contrasted with 26 per cent who had not had an overt attack.

At the end of January 1943 the malarial rate for operational areas in New Guinea rose to a peak of 48 per 1,000 per week, that is, 2,496 per 1,000 per year. Here then was the military malarial problem, stating itself in unequivocal terms. Fighting in a hyperendemic area carried a risk of almost certain infection with malaria, unless troops could be trained to carry out anti-malarial precautions as part of their duties as soldiers in action, and in particular, unless an active suppressive drug could be taken without intermission and with complete reliability. The reputation of quinine as a suppressive, never high among expert malariologists, had receded, though it undoubtedly had high therapeutic value. Hopes were now centred on atebrin.

MALARIA IN THE JAPANESE FORCE

Another very different question was raised about this time, the influence, if any, of nationality on immunity. This was, of course, related to the alleged powers of the Japanese to withstand malaria. An investigation was carried out by Intelligence officers on this subject, based on study of captured diaries and records, and interrogation of Japanese medical officers. This showed clearly that the Japanese forces had a high infection rate from malaria, and, more important still, a high death rate. One medical officer stated that 10 per cent of the men affected died, and in one field hospital (*21st Independent Mixed Brigade*) at Mambare 196 deaths were recorded, of these 80 per cent were due to malaria. The commanders of two divisions, the *20th* and *41st,* also died of malaria. Little was known of the nature of some of the proprietary drugs used by the Japanese for treatment of malaria, but there was little doubt on studying their records that they were not using standard and proven methods. Further, individual medical officers appeared to follow their own ideas in their courses of treatment. Intravenous quinine did not appear to be used by them in severe cases. There was no reason to believe that the Japanese had any degree of immunity to malaria; they were not even in the category of the New Guinea natives who were "salted" in infancy and thus acquired some immunity at high cost. It has been pointed out, however, that the

Japanese made little use of wheeled transport in their occupation of areas in New Guinea; therefore these areas were not cut up with wheel tracks to any great extent, and this may have reduced the concentration of vectors.

There was good reason for believing that the Australian Army was better advised and guarded in matters relating to that major enemy, malaria, than the Japanese, but how fallible were these applications of scientific knowledge to military discipline this campaign had clearly shown. There was little doubt that important lessons of malaria prevention were still to be learnt, but this could not be done simply by maintaining a force in this densely infected area, learning by bitter experience the simultaneous defence against two dangerous enemies. These coastal swamps of Buna-Gona were not contained within a circumscribed area, as in Milne Bay, and the application of preventive methods was limited by logistic difficulties of material, and prophylactic discipline of men. Since the vast numbers of sick could not be held north of the dividing mountain range with its ever-threatening curtain of cloud they had perforce to be crowded into the ever-expanding island base hospitals, only to spill over to the mainland. Victory at Sanananda established a degree of ascendancy over the enemy, but the Wau-Salamaua sector still threatened the flank of the Allied forces in New Guinea, and, despite the successes of Milne Bay, the problem of malaria was not yet solved, though the way had been shown.

CHAPTER 8

WAU-SALAMAUA

WE have seen how the frontal attack of the Japanese on Moresby over the Owen Stanley Range and the flank attack on Milne Bay were associated with a threat by the enemy on the northern flank, when he made unopposed landings at Lae and Salamaua. These landings not only constituted a potential danger to Moresby and provided valuable sites for enemy bases, but also gave access to the Wau-Bulolo Valley.

This area, famous for its alluvial gold mining, had been developed in previous years by the enterprise of air services, which had established airfields capable of linking strategic points in an otherwise most difficult terrain. The precipitous Kuper Range rose to 10,000 feet in places, and cut off these coastal centres from the interior, where in a deep cleft the Bulolo and Watut Rivers flowed in a basin still several thousand feet above sea level. Progress through this country was slow and laborious; it exemplified a common feature of the uplands of New Guinea, where time of travel was much more significant than distance. Travel by foot often demanded incessant clamberings up and down rough rocky ravines and crossing fast streams, and at the higher mountain elevations over 5,000 feet the moss country began, treacherous and forbidding. The usual variants of tropical growth were seen in different parts of this valley, but of a specially wild ruggedness. The foothills, often very steep, were covered with kunai grass, and the slopes above were clothed with thick forest made almost impenetrable by dense jungle growth. Vines and undergrowth impeded progress and even when the banking clouds above did not blot out the sunlight the traveller still passed through a dense gloom below, where rotting vegetation and pervading moisture soured the air. Clothing was perpetually damp and mud clogged the feet on the narrow trails. In such country it was hard to exceed one mile in each hour, and fitness and endurance were demanded of those who patrolled and fought in it.

A fair motor road had been constructed from Wau to Sunshine, and the engineers improved and extended the lines of communications at a later date. The line of communication with Moresby was long and difficult: from the west side of the Bulolo Valley to Bulldog it ran as an undeveloped jungle track, and connected with the Lakekamu River which entered the ocean some 100 miles from Port Moresby. This was the only route which led overland to the southern coast of New Guinea. The Wau-Salamaua area was intersected by numerous rivers. South of Salamaua Peninsula the Bitoi and Francisco Rivers widened out into important streams, and on the west of the dividing ranges the Snake and Watut Rivers joined with the Bulolo River and entered the Markham River, a broad stream which met the sea south of Lae. Wau was the most important settled area, with considerable technical development from its

gold-mining activities. It had a useful airfield, and its elevation, 3,700 feet, limited the propagation of malaria, though the lower jungle areas were highly malarious.

KANGA FORCE OPERATIONS

When the Japanese landed at Lae and Salamaua in March 1942 two companies of the New Guinea Volunteer Rifles were in the area. They carried out demolitions before the enemy arrived and harassed them from the hilly country behind Salamaua, obtaining useful information from patrols. In the latter part of March "Kanga Force" was formed to carry out certain specific tasks in the Wau-Salamaua area. Major N. L. Fleay was appointed to command this force, which comprised the following: a headquarters to be raised from details in Moresby area; all personnel of the New Guinea Volunteer Rifles under the command of headquarters of N.G.V.R.; a reinforcement platoon of the 2/1st Independent Company, which was *en route* to Bulolo; the 2/5th Independent Company; and a mortar platoon to be raised. This force was to come under command of the officer commanding Kanga Force from 1st May, and its function was to carry out such offensive action as was necessary to protect forward bases and airfields.

The Japanese began to move inland from Salamaua, but the largest component of Kanga Force, the 2/5th Independent Company, was held at Moresby, to protect the Bootless Inlet where there was a risk of a Japanese landing. In the early days of May the battle of the Coral Sea dissipated the enemy convoys meant for Moresby, and the situation eased. The 2/5th Independent Company could then be released for its new assignment with Kanga Force. It is of interest that when the headquarters of Kanga Force, the 2/5th Independent Company and a mortar detachment were flown under escort to Wau, the occasion marked the first substantial air movement of troops in New Guinea. The headquarters of the force was at Wau, from which a wide area was covered by patrols, and the headquarters of the components took up positions at Wau, Bulolo and Bulwa, names familiar on the New Guinea goldfields. At the end of May Kanga Force stated the locations of its units as follows: (a) N.G.V.R. headquarters at Bulolo, "A" Company headquarters at Partep 1 with platoon and patrol bases in the Markham area, and posts overlooking Lae; "B" Company headquarters at Mubo with posts covering tracks to Salamaua, and posts overlooking Salamaua; (b) reinforcement platoon 2/1st Independent Company, headquarters at Bulwa; sections at Mapos, Missim and Kudjeru; (c) 2/5th Independent Company headquarters, "A" and "B" Platoons at Bulolo, "C" Platoon at Bulwa; (d) mortar detachment at Wau; (e) headquarters Kanga Force at Wau.

MacArthur and Blamey agreed that the force would be of modest dimensions, designed for hitting rather than holding. Medical care was complicated by the extensive scattering of the force, and by the wild and mountainous country. Under the original organisation each of the

component units had its own medical officer, and the S.M.O. was Captain McKenna who was already experienced in New Guinea. McKenna later returned to Port Moresby where his experience proved invaluable to Angau.

SUPPLIES AND TRANSPORT

The exacting nature of the work and the rigours of the country imposed a great strain on the officers and men, and might be expected to cause a high rate of sickness. This was evident in the N.G.V.R., whose average age was thirty-five, and who, though most enthusiastic and spirited, could not retain fitness under the arduous conditions. Fleay thought that only 90 men out of 300 all ranks were fit for patrol work. The factor of acclimatisation was thought to be of some significance at times. For example, later on when the 17th Brigade came from Milne Bay to Wau, in the 2/6th Battalion, after a long march to the elevation of the Black Cat mine, a number of men collapsed: possibly height as well as heat may have been a factor.

Feeding the force often caused anxiety, particularly in relation to some of the forward patrols. For instance, N.G.V.R. patrols in the high ground behind Salamaua had dumps of food in reserve, but the landing of the Japanese upset these arrangements, and caused stringency of rations. Even in the less inaccessible places the men were often short of rations, and without the solace of tobacco. Sometimes supplements could be obtained from native gardens, but even men experienced in handling the Papuans often found it hard to maintain good relations with the villages. This could be readily understood when the dominant role of the Japanese in the eyes of many natives was considered. Stores of all kinds were hard to get and, when obtained, hard to distribute, largely owing to the difficult line of communications with Moresby through Bulldog. Air transport was of course the obvious ideal link, but it was not regular or always possible until at a later date improvement in the military position permitted increase in the size of air transport fleets, and so made a higher priority possible for this action front. Defence of airfields was all the more vital as a function of Kanga Force. Ground transport was made more difficult by the reduced number of native carriers available, for here, as on similar jungle fronts, the carriers were invaluable in the distribution of stores and the transport of casualties. Control and recruiting of native labour were handled by Angau officers. The same stringency prevailed for medical stores, and supplies often ran low. The nature of the force's function in itself lessened battle casualties, for serious clashes with the enemy were not common. The usual types of medical disability met with in this tropical country could often be treated in camp, or in the hospital at Wau; for men seriously ill, air transport to Moresby could be arranged, but more regular air evacuation was most desirable. Medical assistants carried out a very useful function in this force, and used their special training to good effect; the medical officers took opportunities as they offered for training the men in first aid work.

HEALTH IN KANGA FORCE

The chief cause of ill health was malaria, which was endemic throughout the area in a varying degree, depending largely on the density of anopheline mosquito population. Organised anti-malarial measures were well-nigh impossible in this force, but suppressive quinine was taken. It was recognised that the less soluble bisulphate was not well absorbed in tablet form. Treatment was not as thorough as could be desired, and the relapse rate was high. This produced a considerable amount of chronic illness with anaemia and splenic enlargement. McKenna pointed out that atebrin should give better results, and that adequate supplies were essential. He also advocated removal of men with chronic malaria to a non-malarial zone for rest and further treatment. Lack of facilities for washing and laundry increased the number of staphylococcal and fungous infections of the skin. Dysentery was fortunately rare.

RAIDS ON SALAMAUA AND HEATH'S

At the end of June aggression was threatening on the other New Guinea fronts, and diversionary action was planned in the Wau-Salamaua area. MacArthur and Blamey had agreed that action should be undertaken on Lae and Salamaua when the time was appropriate, and Fleay now received instructions for attacks on the enemy-held bases. The Bulolo Valley already occupied the attention of a considerable number of troops and large-scale operations were out of the question. Accordingly raids were planned on Salamaua and on Heath's plantation as a preliminary to a move against Lae.

Captain N. I. Winning of the 2/5th Independent Company led the raid on several objectives in Salamaua with great success on 28th-29th June. The strength of the raiding party was about fifty, and the Japanese had a force of about 300 in Salamaua. Thorough preparations were made by N.G.V.R. scouts by reconnaissance and continuous manning of observation posts. While the party was at the Mubo base camp members of the N.G.V.R. were medically examined; 25 per cent were found to be "Class II" and the remainder were selected for training with the 2/5th Independent Company. Supplies were far from satisfactory; they arrived late and the reserves held at Mubo were insufficient to meet the sudden demand of the A.I.F. troops. Simultaneous raids were made on a number of points, including Kela village and the aerodrome. The Japanese replied with shelling, mortar fire and machine-gun fire, and as their losses were estimated at over 120 it was remarkable that the raiders had only three men slightly wounded. Japanese aircraft attacked the jungle tracks, but all the men returned to their base on 30th June. Valuable documents, maps and intelligence material were collected.

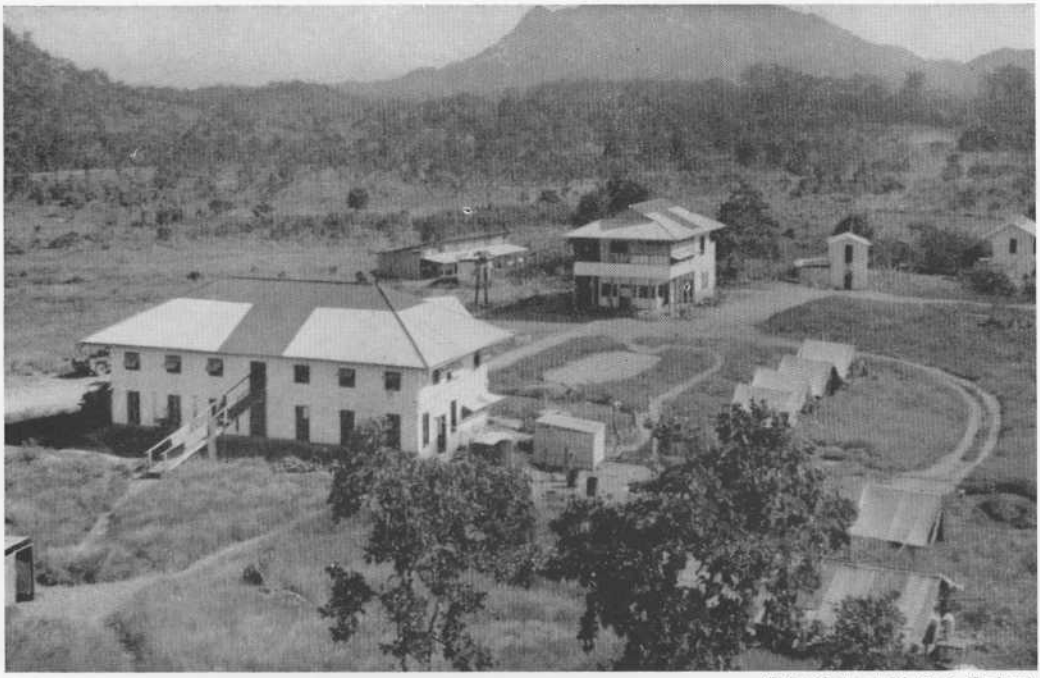
The raid on Heath's, planned as a preliminary for a later possible raid on Lae, was successfully carried out on the night of 30th June-1st July, though the force had to withdraw before all objectives were gained. For various accidental reasons complete surprise was not achieved, but the force was able to inflict considerable damage and loss before its early



Brigadier N. H. Fairley
Director of Medicine
A.M.F.



Brigadier W. A. Hailes
Director of Surgery
A.M.F.



(Lieut-Colonel M. S. S. Earlam)

Bomana Mission, Port Moresby.



(Australian War Memorial)

Stretcher cases being transported back to the base by jeep.



(A.A.N.S.)

The 2/9th A.G.H., Port Moresby, 1943.



(Dept. of the Interior)

Heidelberg Military Hospital.





(Australian War Memorial)

The A.D.S. at House Banana.

retirement. Major T. P. Kneen, of the 2/5th Independent Company, who was in charge of the raid on Heath's, was killed in this action.

The holding force in the Markham Valley area consisted of about 100 N.G.V.R. men; examination showed that only some sixty were medically fit for patrol work. Arrangements were made to give some respite to the N.G.V.R. and also to a section of the 2/5th Independent Company. The strain on the troops was not merely that imposed by the meticulous preparations for an aggressive raid, or that of the raids themselves, it was cumulative. The defence of the Bulolo Valley occupied a considerable number of the force in supplying the daily patrols, clearly described by the diarist of the 2/5th Independent Company:

> Picture a force dwindled by malaria still gallantly carrying on the tasks assigned it, climbing hand-over-hand up precipitous mountain sides, slithering knee-deep through jungle swamp, wading boulder-strewn streams, wet through continually, and yet with indomitable "guts", never ceasing their probing of Jap lines.

The Japanese reacted sharply to these raids. The enemy air force probed inland from Lae and Salamaua and bombed Mubo and Komiatum, south of Salamaua, shortly after the raids. Attacks were also centred on the Bulolo Valley, and some damage was inflicted on Wau and Bulolo. Enemy reinforcements, about 200 strong, were brought from Lae to Salamaua. Both at Heath's and Salamaua enemy patrols showed great activity: this made it more difficult for Kanga Force to move about, as some of their hitherto hidden tracks were no longer concealed. Another result of hostile action was the effect on the native carrier force. This was particularly felt at Wau on 2nd July where some material damage was done by Japanese planes; here the labour and carrier forces of Papuans fell away alarmingly, and on the 3rd, air attacks caused further thinning of the carrier forces at Bulolo. Supplies became more scarce, and some of the reserve dumps of food were found by the Japanese. Immediately after the Salamaua raid rations were very short: seventy-two men had between them only eleven tins of soup, and seven pounds of rice, with no tea or sugar. The Bulldog line of communications to Moresby was not able to produce a steady flow of stores.

THE JAPANESE EXERT MORE PRESSURE

During July the 2/5th Independent Company found the conditions very trying; they lacked supplies, and had to cope with shell fire and a more active enemy, half their men were sick and many showed signs of exhaustion. Nevertheless the strain on this unit was less severe than on the N.G.V.R., and during July A.I.F. troops replaced others in the areas forward of Bulolo and Wau. On 2nd August a hospital was opened in the Guadagasal Saddle area south of Mubo, with a base at Wau. From Mubo to Wau it took three days to transport casualties: Wau and Bulwa were connected by road, and the distance could be covered by motor transport in an hour and a quarter. In the Lae sector transport times were

greater. From forward patrol areas to a small hospital at Dargan the time taken to carry a stretcher was twenty-four hours and thence to Sunshine four days. At the hospital bases a medical officer and orderlies were stationed. With the devastating journeys to be made through such rough country the problem was not so much that of treatment but that of transport. The medical assistants were able to take considerable responsibility and ran small hospitals with ability. Warrant Officer G. K. Whittaker, who was running a hospital at Bob's, hearing that an Australian was wounded during a Japanese attack in the Markham area, made a six-hour journey on horseback, found him in the bush and succeeded in taking him to Nadzab where a canoe took them back to Bob's camp.

At the end of August a party of Australians was involved in a long and hazardous journey. While Winning was leading a patrol to Busama a depleted band of forty-nine men left in Mubo was threatened by a large band of 130 Japanese, and was forced to attempt a formidable journey over the mountains to the Bulolo Valley. The men suffered great privations in climbing up the range to 10,000 feet, and returned to a post whence, with the help of a friendly native they reached the coast. At one stage they eked out scanty rations by subsisting on a few sac sac trees. They obtained food and canoes and a week later reached the Waria River; barefooted and in rags they arrived at Garaina, after five weeks of struggling through difficult country, and there they met a plane which was establishing a supply dump, and were flown back to Moresby.

The increased activity of the enemy on other fronts was reflected in the Wau-Salamaua sector by the end of August. The landing at Milne Bay and some success on the Owen Stanley Range encouraged the Japanese to press on at Mubo, and the Australian force in this area was unable to retain its forward posts. Despite the infiltration of the Japanese and the capture of Guadagasal the Australians had been able to inflict heavy damage on the enemy in the Mubo gorge without loss to themselves. But, with Mubo lost and the enemy able to maintain a flow of reinforcements into Salamaua, the situation of Kanga Force was changed and the commander realised that it could not then have a high priority in all moves designed to resist the threefold drive of the enemy. Accordingly he decided to burn out and abandon Wau and Bulolo, for it did not seem possible to hold the Bulolo Valley.

The defending force was thus divided; the main force fell back on Kudjeru, and lost contact with the troops in the Markham sector. During the later months of 1942 Kanga Force was chiefly engaged in active patrolling.

During September the Mubo and Markham sectors remained quiet, but the force was able to continue its modified role of harassing the enemy in these areas, and to assure that the Bulldog line of communication with Moresby was kept open, and denied to the Japanese. On 9th October reinforcements from the 2/7th Independent Company arrived at Wau, and began some reconstruction work.

MEDICAL STATE OF THE FORCE

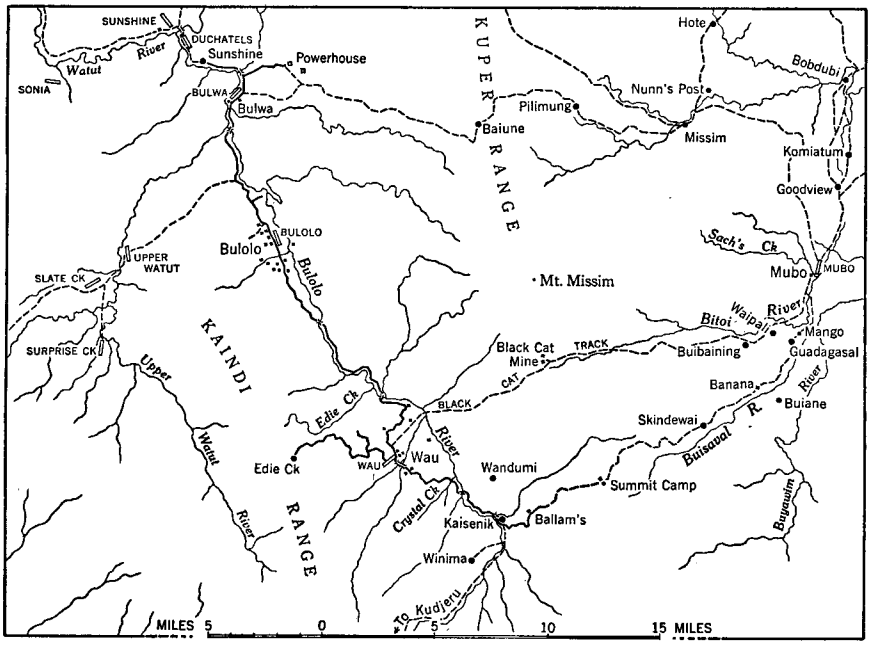
The health of the troops was the subject of several surveys at this time. Captain E. W. Stout, R.M.O. of the 2/5th Independent Company, reported in September that "gastritis" and diarrhoea were prevalent among the men, believed to be due in part to difficulties in digesting a diet consisting largely of bully beef. Few vegetables and little fruit were available. In a later report Stout expressed the opinion that, even judged by the average standard of health among the local troops, 29 men out of 117 examined were not fit for tropical service and should be returned to the mainland for medical reasons. Many of the men had attacks of that vague entity "low fever", no doubt an incompletely controlled malarial infection. Frank malaria was common. Many had septic sores due to infection of scratches, and their ragged dirty clothing made them liable to these and other skin affections. Fresh food was badly wanted, and could be little supplemented from native sources. In some places the natives were living on a diet consisting of little else but bananas. After the arrival of reinforcements, Stout of the 2/5th and Captain J. M. McCracken of the 2/7th Independent Company agreed that the men who had been through this arduous period were not fit for really hard work.

In December the Japanese became more aggressive, especially against the Saddle position, but Kanga Force now had the help of reinforcements, and on 11th January raided Mubo in strength. In spite of the evidence of deterioration of some of the troops, this raid showed that they still had the capacity to carry out a hostile action. Over a period of three days the operation went on. The raiders were successful in taking high ground to the north of Mubo, but the enemy launched heavy counter-attacks on these positions, and the Australians were forced to withdraw to Skindewai. This was the last action undertaken by Kanga Force as originally constituted. There was no doubt about the meaning of the Japanese infiltration inland, which had been going on for some time. A new phase of the long-smouldering activity in the Wau-Salamaua sector was beginning, and to meet the call of a full-scale campaign a larger force was necessary. On 15th January 1943, the first elements of the 17th Infantry Brigade reached Wau and the advanced headquarters arrived on the 17th. Under Brigadier M. J. Moten this brigade assumed command of Kanga Force.

ARRIVAL OF THE 17TH BRIGADE

The movement of the 17th Infantry Brigade to Wau began with the 2/6th Battalion with medical support from a light section of the 2/2nd Field Ambulance, under Captain N. R. Scott-Young. The characteristically unstable flying weather over the mountainous area surrounding Wau was not very favourable, but by 23rd January the reinforcements enabled covering to be provided at the main points of approach to Wau. Major W. D. Refshauge took over a few days later as S.M.O. of Kanga Force, and with reinforcements flown in after the 30th, formed a composite company. The numbers brought in were kept to the minimum because of the great need for combatant troops. Active patrolling towards the Saddle

area and Mubo showed that the Japanese were moving down the Mubo Valley along the Black Cat track. In order to achieve surprise, the enemy had sent only small parties along the usual tracks, and planned to send the main force by an old unused trail originally surveyed by an early German settler. The arrival of this force in Wau was delayed by two causes, the great difficulties of this wild trail, and the gallant delaying action of a company of the 2/6th Battalion which met the Japanese near Wandumi on the 28th.



Wau-Mubo area

Meanwhile, bad weather had delayed over half of the 17th Brigade for several days, and only a thin Australian force could be spared to guard the aerodrome at Wau. The medical personnel were strategically placed. On the 25th, the day after Refshauge's arrival, the Australian troops needing medical cover were placed at Wandumi, the Black Cat area, and the Kaisenik-Summit area; an attack was expected on the 28th. This began early in the morning and the Japanese were able to push past Wandumi in the afternoon and during the night to establish positions on the higher ground ringing the airfield, some as close as 400 yards.

Heavy rain during the night brought dense cloud over the airfield next morning, but just in good time this dispersed, and fifty-seven transport planes arrived from Moresby with the 2/5th and 2/7th Battalions. Troops were actually landed under small arms fire, but the movement was suc-

cessfully completed. The next day sixty-five transports came into Wau with equal success, in spite of a heavy attack on the airstrip by the enemy, who fired on the planes and the troops they brought. More members of the 2/2nd Field Ambulance arrived at Wau during these two days, and helped in the carrying out of the medical organisation planned for the anticipated actions. This was timely assistance, as fighting persisted round Wau against some 2,000 to 2,500 enemy troops.

CARE OF CASUALTIES

The medical arrangements had provided for an A.D.S. about one and a half miles south-east of Wau aerodrome, and south of the Wau-Crystal Creek road. This had thirty-five beds, but the number was increased later to 124. A loading post was set up at the Wau airfield, and with an R.A.P. was later sited in an excavation in the side of a ravine, and could accommodate twelve lying and twenty sitting patients. This was of importance quite apart from the early happenings at the aerodrome, for it was obviously necessary to have a holding post quite close to the airstrip for future air evacuations. The surgical work during the actions at Mubo and Wau was carried out by a surgical team from the 2/9th A.G.H. and the staff of the 2/2nd Field Ambulance. The 2/9th A.G.H. team consisted of Major D. R. Leslie, Captain W. P. Ryan and two orderlies; its equipment was based on that used for a light surgical team in the Middle East. The threat in the Mubo area made it necessary for this team to move to the Black Cat mine three hours after its arrival in Wau. The move was made with difficulty, and the next morning it was apparent that the 2/6th Battalion and the surgical team were in danger of being outflanked. The surgical post was therefore set up half-way back to Wau on the Black Cat track with a guard of four men. The S.M.O. recalled Ryan and an orderly to Wau to work at the surgical post at the airfield, and the rest of Leslie's team remained on the Black Cat track for three days. There were only a few casualties here, and the area was dangerous, hence the team was moved nearer Wau close to the battalion's headquarters, and was then recalled to Wau by the S.M.O. on 1st February. At the busiest time Major Refshauge, and Captains Scott-Young and D. R. Reid, with Captain Ryan as surgeon, and fifty-six O.Rs. were working there.

During this action casualties were collected by stretcher bearer squads attached to each medical officer, but shortage of staff made it necessary for field ambulance bearers to collect wounded forward of R.A.Ps. or to form relay posts. Captain B. H. Peterson, R.M.O. of the 2/7th Battalion, described the conditions:

> I took a squad of stretcher bearers forward and two squads of 2/2nd Field Ambulance bearers formed relay posts along the steep, rough, narrow track at intervals of about 300 yards. (100 yards on this track was like a mile.) Anticipating the steepness and difficulty of the track, we used the boat-shaped wire-netting stretchers used by the miners. We could not have evacuated stretcher cases without them as they had to be half slid, half carried down. They had to be strapped in these stretchers as it was. It was very hard work, but the stretcher bearers did a great job.

Some men were wounded on the airfield; after receiving first aid they were sent straight back to Moresby. One soldier was operated on in Moresby five hours after arriving by plane at Wau. As far as possible only casualties likely to be fit within seven days were held at the Wau A.D.S.: all others were returned to Moresby as soon as desirable. Medical supplies were prompt and satisfactory, but great difficulty was experienced in the replacement of stretchers, splints and blankets. Arrangements were made later for a tally of these stores to be sent after each evacuation so that replacements could be given high priority with the next despatch. An ambulance waggon was fitted up on a salvaged motor van, and with a sedan car was used for evacuations. Trailers were tried without success at that time, although they were successfully used at a later date. Heavy fighting persisted on the outskirts of Wau for twelve days, and as the defenders pressed the enemy back, the action ranged along the Bulolo River at Crystal Creek. On 9th February, twelve days after the attack on Kanga Force began, the enemy withdrew across the Bulolo towards Wandumi, and several days later the Australians had cleared this area. There were 207 battle casualties and 335 sick treated during this period.

Medical officers found, too, that many of the men on patrols needed advice and care. Captain W. M. Quinn, R.M.O. of the 2/6th Battalion, found that after one or more nights in the jungle they were exhausted from exposure and lack of sleep, but a night's rest and attention to minor discomforts soon restored them to full capacity. A convalescent depot was started by Refshauge at Kaindi, Edie Creek: it was functioning before the attack started and when the main threat had passed was taken under command by Captain H. E. Marsden early in February. It proved very valuable to men not yet fit for resumption of duty.

During the hard fighting by the 2/5th Battalion at Crystal Creek, difficulties were encountered in extricating casualties from awkward spots which could often only be reached by hard climbing. Stretchers of the wire cage type were found most useful; carriage was facilitated by lashing handles to each end.

On the 11th the situation was quieter, and a pocket of enemy resistance had been partly dealt with; the 2/5th Independent Company was withdrawn to rest, with the hope of a fortnight's relief for recuperation and dental attention. Lieut-Colonel R. S. Smibert, commander of the 2/2nd Field Ambulance, arrived at Wau on 13th February and assumed the responsibilities of the S.M.O. Kanga Force. In his early reports he emphasised the changes necessary in medical arrangements now that the military situation had altered. The movement of troops to the Bulolo area and towards the Markham area had to be covered; for instance, two medical officers were wanted for a small force going to Bena Bena to establish and cover an airfield, and one for forward work with the 2/6th Battalion. On the other front, the Mubo area, medical posts were set up at Skindewai and at Guadagasal, on the Skindewai-Saddle track: both these posts had facilities for surgery, which was begun in March and April. Ryan and

Leslie acted as surgeons to the teams, and Smibert organised the collection and evacuation of casualties.

In general terms, the preventive aspect was assuming greater importance, with regard to malaria. Though arrangements had been made for a mosquito survey, events had not permitted this; now it was essential, starting with the Bulolo area. Anti-malarial stores had also been indented. Major A. W. M. Hutson arrived on the 15th as a physician to the force and advised on medical conditions in the field. The practical applications of malaria control became an important issue. For example, it was found that during action the 2/6th Battalion had left their nets in unit dumps: arrangements were made to collect them later. The commanding officer was confident that the men would resume the use of nets without trouble when circumstances permitted and made it desirable.

MEDICAL PLANNING

A staff directive from New Guinea Force headquarters at this time indicated the strategy of future operations. The holding of Lae and Salamaua by the Japanese was being made expensive by air operations, and was forcing them to bring troops through the Markham Valley from Madang. This emphasised the vital importance to the Allied forces of the Bulolo area. Wau-Bulolo must be held, and the Wau-Bulldog line of communication down the Lakekamu River was to be developed by construction of traffic facilities. These plans involved the expansion of Kanga Force to divisional strength, with corresponding demands on the medical services.

On the 18th an A.D.S. at Bulolo was ready to receive patients, and arrangements were being made for Captains McCracken and D. W. MacPherson to do necessary surgery at Skindewai, from which area the 2/7th Independent Company and the 2/5th Battalion were making raids on the 21st. Stored blood had been provided from Moresby during the action, and was still available for use: it was found to be usable only for five days after arrival. During quiet periods supplies were reduced. Anti-malarial precautions were enforced in the whole area by an order of Kanga Force. During the Wau action some units had been unable to ensure that all forward troops received suppressive atebrin. As Ford had pointed out, the malarial danger in any particular sector was not so much one of heavy local infection *per se,* but the risk of the satisfactory malarial control at Wau engendering a false security in troops entering the highly endemic Markham Valley without adequate preparation. Another important medical matter emerged at this time, the distribution of scrub typhus. The endemic areas were in some instances known to the Angau representatives, such as Crystal Creek and Edie Creek: personal experience confirmed the notoriously patchy incidence of this disease.

Brigadier Disher, D.D.M.S. New Guinea Force, summarised the position at 23rd February. The M.D.S. at Wau was in buildings and tents, and could hold 130 to 150 patients: the surgical team was stationed here. The aerodrome R.A.P. was being enlarged by digging into a cliff

150 yards from the strip. Five miles from Bulolo, and fifteen miles from Wau, the A.D.S. was able to hold casualties from the 2/6th Battalion. The Bulolo aerodrome was being prepared for use by transport planes. Aid posts of the 2/7th Independent Company and the 2/5th Battalion were at Skindewai; from here native carriers took one and a half to two days to bring patients to a jeephead, whence they were taken to Wau M.D.S. The rest station for convalescents could take fifty men, and hold them for a week or more as required.

Smibert in a report made clear some of the difficulties of transport of sick and wounded. Lying patients were carried by native bearers, but these were few in number. The lines of evacuation likely to be used in future engagements were numerous and long as well as being most difficult. The approximate times for carriage by native bearer teams showed this. For example, Skindewai to Crystal Creek jeep post in three stages occupied twelve hours; Black Cat mine in two stages to Bulolo River took eight hours; Bob's camp to Sunshine by four stages took twenty hours, and then motor ambulances could travel from Sunshine to Wau in two hours. Telephone communication was possible between a number of the staging posts, but as dispersal of the force increased more medical staging posts would be required, covering growing distances, though the help of Angau in looking after camps on the tracks was most useful. Even when casualties reached Wau the uncertainties of air transport to and from Port Moresby introduced further delay.

HEALTH AND NUTRITION

Refshauge reported to the D.D.M.S. that activity was slight at the time, but pointed out that special care was needed to prevent dysentery and similar infections arising from the fouling of the ground in areas previously occupied by the Japanese. Supplies were becoming an acute problem: the field ambulance complained that the food was monotonous, and warned that there were signs of vitamin deficiency among the men. MacPherson found that food was of good quality, but mainly tinned, and that the quantity was inadequate for troops engaged in or resting after hard fighting. An increase in forward rations, especially the provision of hot meals, was found to increase the stability and stamina of the men: on "hard" rations troops lost appetite. In his opinion milk, tea and sugar were required in liberal quantity during action, and further supplies were needed, and an even higher calorie diet was advisable under the arduous conditions of the campaign. McCracken was also dissatisfied with rations received by his unit. After the enemy attack on Wau the unit was cut off from land based supplies, and for ten days was dependent on unsatisfactory air-dropping. A point which may be mentioned in this connection affected numbers of areas. Unless food packages were retrieved they often caused increase in fly breeding: this was particularly evident when meat was included. By the end of the month the area from Waipali to Buibaining was cleared of Japanese and on 1st March the Mubo Valley was also under control.

On the 2nd began the air-sea action since known as the battle of the Bismarck Sea. The Japanese were known to have considerable concentration of ships in Rabaul Harbour, and when a convoy of twenty-two transport and supply ships with naval escort was observed to leave Rabaul and approach the Vitiaz Straits, it was rightly assumed that this carried reinforcements for Lae. General G. C. Kenney sent a powerful Allied striking air force to intercept them and during the 3rd and 4th most of the convoy was destroyed. Without control of Lae the Japanese could not possess the Markham Valley, and their plan of coming down from the Madang area was upset. Blamey's strategy, approved by MacArthur, was now to secure a sea-land base at Nassau Bay, and to divert the enemy's operations from Lae to Salamaua, thus facilitating the capture of Lae.

Early March found Kanga Force sending aggressive patrols into the Markham area, and occupying the heights overlooking Mubo and the Bitoi River winding through the mountains.

Conditions were still unsatisfactory in some camps. At Skindewai, Refshauge found cover for only 200 men, and poor hygiene. These conditions did not necessarily reflect upon the men at this and other forward posts, for there were hardly any men who could be spared for the tasks of hygiene except convalescents, and tools were non-existent. Latrines made from dehydrated potato tins helped to improve sanitation. Some of the shelters erected for patients were at first rough: until sisalkraft could be dropped from the air about June, only the bark of trees was available for roofing. Supplies mostly arrived by free dropping which caused many breakages. Packages were only recovered with difficulty: in moss forests the problems may be imagined. Yet camps such as Skindewai of this period could not be described as other than bad. More discussion went on about rations. Since chocolate was not regarded as an emergency ration, a daily issue of two ounces per man was requested. Unpolished rice was preferred by the independent companies, but polished was supplied. A man with clinical signs of beriberi was admitted to the M.D.S. of the 2/2nd Field Ambulance. Hutson found other men in the field with evidences of early vitamin *B* deficiency, though when some of these men were later returned to Moresby doubt was cast on the validity of analgesia as a sign of thiamin deficiency.

The general health of the 2/5th Independent Company was the subject of investigation at this time, and there was some difference of opinion. Brigadier Moten felt that Stout, the R.M.O., was making too much of the deterioration in stamina and health in this unit, but Smibert, the S.M.O., thought that any regimental medical officer would agree that certain factors were important in addition to endemic disease, such as boredom and the constant threat and tension engendered by the menace of numerically superior enemy forces. The more obviously affected men were examined by Refshauge, particularly with reference to their blood state. He found that twenty-four men averaged 82 per cent haemoglobin. Hutson and Stout examined 114 officers and men of the 2/5th Independent Company, and classified only eight as fully fit, twenty-seven as partially fit, fifty-six

as temporarily unfit, and recommended that twelve others be evacuated or sent for medical board, and the remaining eleven be the subject of later decision. General deterioration was found in these men, who had served for eighteen months in a tropical area; this was considered to be due chiefly to chronic malaria and mild dietary deficiency. It will be conceded that the diagnosis of early vitamin deficiency is not always easy, but there seems little doubt that these men showed decline in general condition, due to multiple causes. On the 23rd, by order of force headquarters intensive treatment of the 2/5th Independent Company began with injections of vitamin *B*. The unit was not moved out, but was given further rest at the rest camp.

MEDICAL ARRANGEMENTS

Further changes were made in the disposition of medical officers in the latter part of March, to provide more help in forward areas, and to allow for wear and tear. A detachment from the 3rd Field Ambulance in Moresby was sent to work at Bulldog-Edie Creek, where the members could gain useful experience. Later a detachment from the 15th Field Ambulance was sent to Wau for attachment to the 2/2nd Field Ambulance. Ryan and Stout were returned to Moresby; the former had a tendon accidentally severed in one finger and was replaced by Major J. M. Yeates. The general medical arrangements were also altered to provide for expected activities, which had begun on 9th March with the forward movements of troops. As might be expected in this type of country, illness was an important cause of wastage: the A.D.S. at Bulolo had an average number of fifty patients, most of whom had malaria. Scrub typhus continued to occur irregularly; in the last three days of March thirteen cases were diagnosed in the 2/7th Battalion area west of Kaisenik. The distribution of typhus round Wau township attracted special notice. Smibert's report stated that the incidence in this area was "rather extraordinary". He pointed out that seventeen cases had occurred within half a mile of the aerodrome.

> If a line is drawn at right angles to the long axis of the drome, all the cases, except one, are to the left or west of this. The other case was contracted at the S.E. corner of the drome. The people in this area have a far higher percentage of cases than any other body of troops, including those who are working in the jungle.

The percentage of troops in this area was only slightly higher, but numbers of troops living in similar conditions round the aerodrome remained well. In the Kaisenik area the men infected represented 8 per cent of the personnel. On 31st March more casualties were occurring west of Mubo, but the staging post at Skindewai was in working order, accommodating twenty medical and twenty surgical patients, and was provided with an adequate operating hut with water laid on through bamboo pipes.

On 10th April medical officers were well spread out, with a surgical team in the Saddle area and at Wau, and posts at Skindewai, Kaindi, Bulolo, Partep 2, Wampit and Missim. Some days later the 2/7th

Independent Company was given a period of rest in the Wau area, so that the opportunity could be taken to deal with the men of this unit should they need intensive vitamin treatment.

EXPANSION OF THE FORCE

Both the 2/7th Independent Company and the 2/5th Battalion were being relieved, and were replaced by the 2/7th Battalion. The time for further expansion of Kanga Force to a division was at hand, and in anticipation of this Colonel N. H. W. Saxby, A.D.M.S. of the 3rd Division, had already arrived, on 2nd April, to investigate the medical conditions and problems of the area. The administrative headquarters of the 3rd Division took steps to have field operation rations dropped to forward areas, and to have deficiencies made up by issues of marmite. It was realised that there was evidence that the dietary of the forward troops was deficient in vitamin *B*, and they were suffering in consequence from poor appetite and lassitude. Malaria was also increasing in incidence; a sudden increase in admissions was observed in the last week of April.

On 19th April Colonel Saxby took up the duties of A.D.M.S., and on the 22nd, 3rd Division headquarters arrived under command of Major-General S. G. Savige. On the same day a light section of the 15th Field Ambulance was ready to leave for Wau, but was delayed by bad flying weather. Kanga Force ceased to exist.

It will be seen that when the early and intermediate stages of Kanga Force had passed, and the force graduated into the responsibility of fitting into the major strategy of the New Guinea war, the medical as well as the military problems assumed greater importance and greater difficulty. The existence of well-known centres of civilisation famous for the lure of gold, had been of some help to those who were asked to fill a strenuous military role with few resources, but perhaps this tended to make less obvious the great dangers and asperities of the undeveloped areas of this country. The mountainous terrain, the long drawn-out tenseness of the force's task, the menace of the same tropical diseases and the inadequacy of transport had imposed a great strain, but there was no doubt that this could be borne all the better by a force competent in size and training to take up the task. Experiences in Milne Bay and in the Kokoda-Buna fronts had prepared the medical services for their part in a fully fledged campaign designed to sweep the Japanese from their holdings on the northern coast and its hinterland.

OPERATIONS OF 3RD DIVISION

The assignment of the command at Wau to the 3rd Division showed clearly how important was this mountainous area stretching between the goldfields and the northern coast of New Guinea with its important sea-land bases. At this time Allied troops were actively engaging Japanese forces on two fronts only; one of these was Wau-Salamaua, the other was northern Burma. The plans of the Allies in New Guinea were being

fitted into a wide strategic pattern. Savige, the divisional commander, at first only had available the 17th Brigade and two independent companies with some artillery. His initial task was that of maintaining a mobile defence which would facilitate the development of an offensive in an active operational zone. This zone, of course, had its focal point at Salamaua, though no direct attack on this base was as yet planned. The 15th Brigade was not yet available, and did not arrive at Wau until the end of May. The enemy had been expelled from Wau, and a line of communication was being maintained through Bulldog to the Lakekamu River to the sea and thence to Moresby. He still held Salamaua, one of the keys to possession of the valuable north coast, and over the rough mountainous jungle fanning out from the civilised goldfields to the seaboard, bitter actions were expected. This country was not merely difficult for all military manoeuvres, it imposed on contending forces a constant struggle for the heights.

It will be seen, therefore, that in spite of holding good bases at Wau and Bulolo, where there were some amenities, the Australian force would require adequate medical attention at numerous staging posts along a most difficult line of communication. Further, medical and surgical work of the "acute" type would have to be undertaken in forward areas, in medical posts pushing on in close contact with the exploring or advancing troops. Here the art of extemporisation would have full play in independent and mainly self-contained surgical centres, budded off from larger medical units. From these posts evacuation of sick and wounded would at this stage be chiefly back to Bulolo and to Wau, and finally to Moresby by air.

When the 3rd Division assumed command, this part of New Guinea could be divided into a number of areas of topographic and strategic importance; these were Wau-Bulolo, containing the goldfields; Mubo and Missim both of immediate significance; Markham leading to the inland valleys between mountains and sea, and Nassau Bay with its potentialities for sea landings. Through these broadly defined areas ran several tracks. The Wau-Mubo track led from the goldfields over high mountains and sharp rocky ridges, reaching 6,400 feet at Summit camp. At Missim a track curved down into the valley of the large winding Francisco River, and on through Bobdubi over more open scrub country to Salamaua. Two other tracks led north to Nadzab and the Markham Valley, one westerly through Wampit, the other towards the east from Sunshine through Wagau along the Snake River Valley.

MEDICAL ORGANISATION

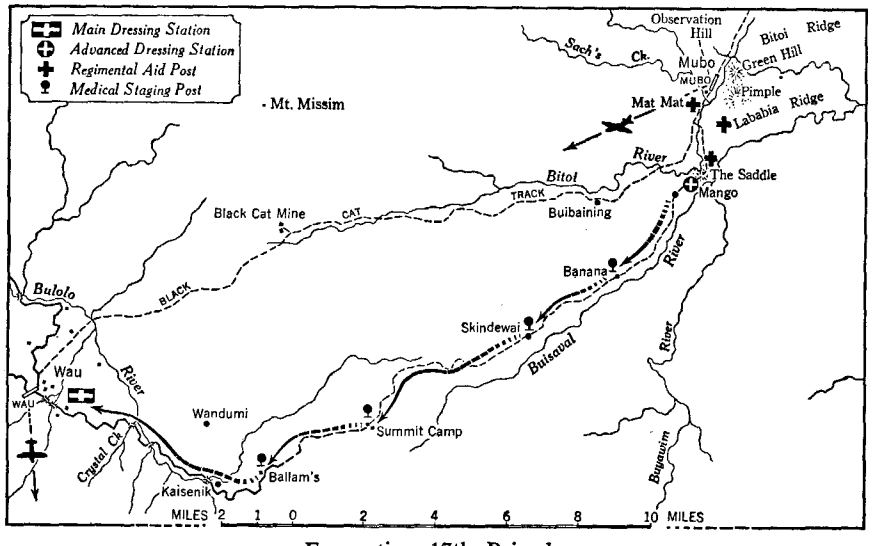
On 22nd April the medical dispositions were as follows. At Wau was a main dressing station of 150 beds; here good surgical facilities were available, and sick and wounded needing treatment at a hospital base could be flown direct to Moresby. An advanced dressing station of fifty beds was at Bulolo, from which patients could be transported by road, either by jeep or by a motor van transformed into an ambulance by local ingenuity. A regimental medical officer was also centred at Bulolo.

The 2/7th Battalion attacked the elevations known as Pimple and Green Hill on the 24th, but failed to break the enemy's hold. An additional medical party arrived at this time, a light section of the 15th Field Ambulance, which was training in Moresby. Until the 3rd Division assumed command, the medical services of Kanga Force consisted of the 2/2nd Field Ambulance, whose strength was brought up to eleven officers and one hundred and eighty other ranks. This unit supplied medical services for all posts in the Bulolo Valley and along the Markham, Missim and Mubo lines of communication. At this time the personnel of the 2/2nd Field Ambulance were in twenty-two separate sites in New Guinea. As the increasing needs of future operations became clear further help was provided. The strength of the 15th Field Ambulance was increased to eight officers and one hundred and sixteen other ranks, and four officers and thirty other ranks on the establishment of the 2/1st Australian Mobile Operating Unit were also brought under the 3rd Divisional command. These additions were made during May and June. Refshauge was promoted lieutenant-colonel, and placed in charge of the 15th Field Ambulance. The A.D.M.S. discussed plans with Smibert and Refshauge in the light of the projected operations, and the organisation was set up accordingly.

The Australians had taken part of Bobdubi Ridge early in May, and shortly afterwards captured high ground at Coconut Ridge. The enemy sustained heavy casualties from these actions, and his lines of communications from Salamaua to Mubo were disrupted. On the 14th the Japanese counter-attacked, and forced the Australians to withdraw from Old Vickers near Bobdubi.

Though these engagements did not inflict substantial loss on the Australians, the wastage from disease was more serious, as men were being sent back every day with malaria and dysentery. Already it could be seen that the losses from disease in recent campaigns had left no deep cautionary impression on the troops carrying the war into new areas. The change from quinine to atebrin as a suppressive of malaria should have brought about a fall in sickness rate, but this hope was not yet being fulfilled. Hygiene too was suffering that neglect which is only too common, especially in small communities. Refshauge, who remained in the Missim area, laboured to improve the general standards in the medical posts, though the greatest difficulties arose not there, but among the combatant troops, especially under operational conditions. New Guinea Force headquarters on 20th May gave Savige his instructions for the prosecution of the campaign: "To threaten Salamaua by aggressive overland operation from Wau-Bulolo Valley, and by thrusts along the coast from the Morobe area." A week later the 15th Brigade arrived, and on 8th June took over all troops in the Missim area, and the headquarters of the 2/6th Battalion assumed command of the Mubo area, which was the responsibility of the 17th Brigade. The 2/3rd Independent Company, patrolling in the Namling area, noted considerable movement and activity among the Japanese troops on the main Salamaua-Komiatum track. Active opera-

tions were proceeding in the Mubo and Missim areas; under these conditions aid posts were necessary at frequent intervals, especially in view of the nature of the country and the limited transport facilities. Extensions of the medical services permitted an A.D.S. of thirty beds to be established at Missim; here and at Pilimung arrangements were made for surgical work to be carried out. In the Markham area a medical post was set up at Sunshine, staffed by the 15th Field Ambulance, and patients were sent on from here to the A.D.S. at Bulolo. The mobile operating unit took over this A.D.S., thus freeing a detachment of the 2/2nd Field Ambulance which was then able to return to Wau.

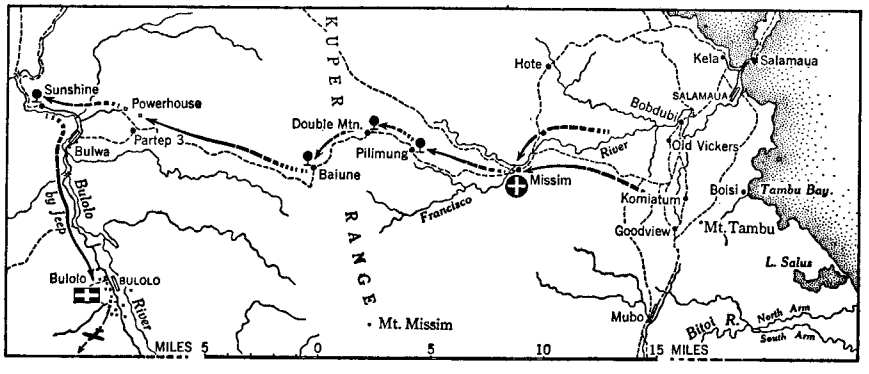


Evacuation 17th Brigade

These moves were in accordance with the conference of the A.D.M.S. with Smibert and Refshauge held several weeks earlier. They had agreed that 10 per cent increase in the battle casualties might be expected in the forthcoming engagements, and made their arrangements so that early surgical treatment and transfusion of blood or serum would be freely available. Recognising, too, that emergencies would throw a strain on staff and supplies, reserves of both were sent as far forward as possible. Additional stocks of surgical instruments were also obtained from Moresby and sent to Missim. The operating unit supplied two surgical teams, and at the end of June such medical officers as could be spared were sent forward in reserve. Smibert and Refshauge were appointed as S.M.O. of the 17th and 15th Brigades respectively, at Skindewai one and a half days' march from Mubo, and at Missim. The general scheme of evacuation provided for a steady emptying of the forward posts, as conditions permitted, while the rest camp was kept full. The M.D.S. at Wau and the A.D.S. at Bulolo maintained a maximum of 100 and 40 patients

respectively, though further expansions of bed states were to be made by July. All sick who were not expected to be well within three weeks were sent back to Moresby. The movement of sick and wounded and carriage of supplies depended chiefly on native bearer squads, but even with expert handling these were hard to get and still harder to keep.

In the Mubo area the R.M.O. of the 2/6th Battalion was at the Saddle, and had forward R.A.Ps. at Mat Mat and Lababia. Here, a sharp enemy attack on 21st June made it necessary to operate on wounded under a tent fly with few facilities. At Mango in the Guadagasal area was an A.D.S. with thirty-five beds, to which a surgeon was attached. A smaller staging post of sixteen beds was sited at House Banana, where patients could stay overnight, as also at Skindewai, Summit and Ballam's, where there was a jeephead. These posts were two to three hours apart, so that walking wounded could take easy stages. Stretcher cases could traverse the line of communication in two to three days without undue fatigue.



Evacuation 15th Brigade

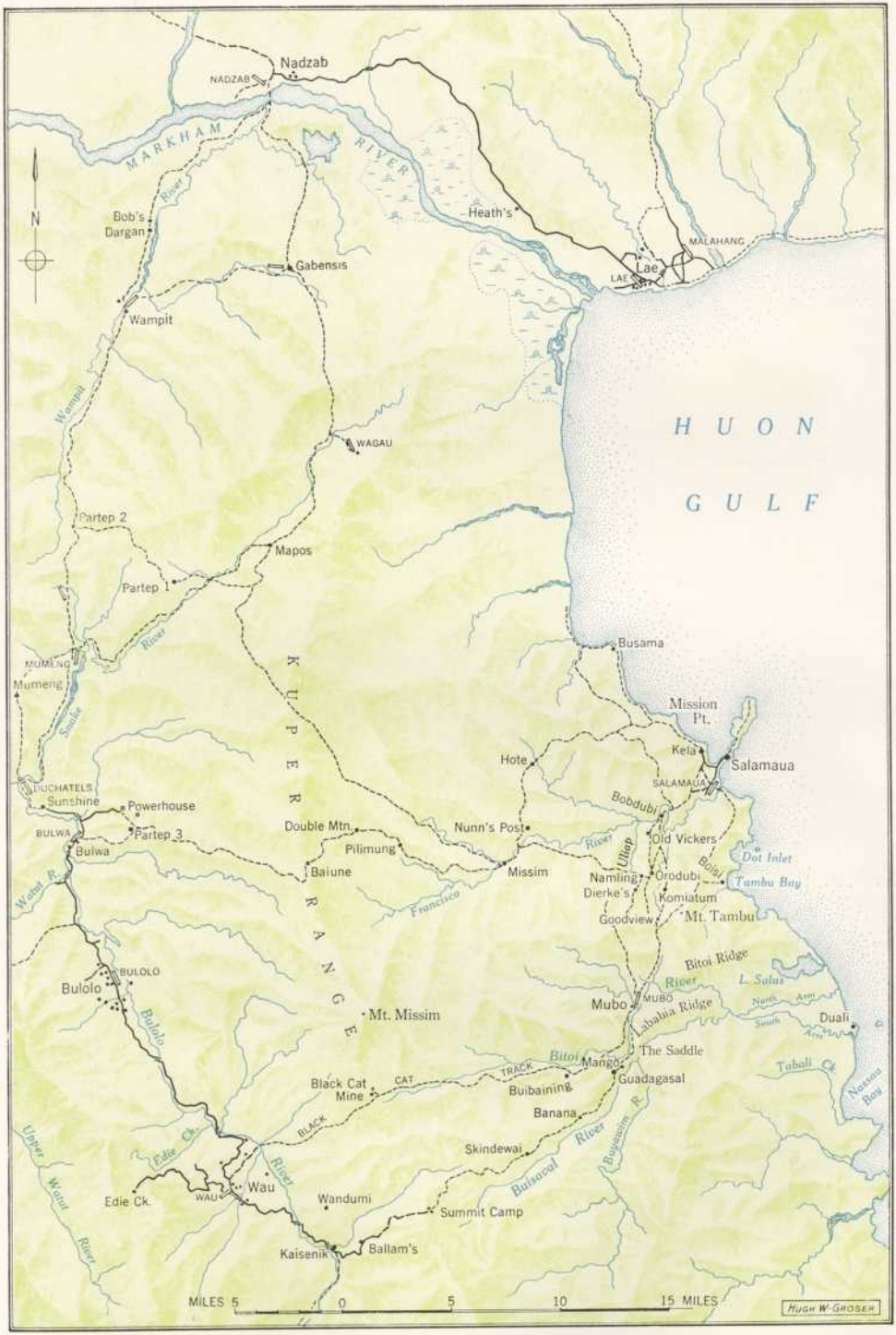
In the Missim area advanced staging posts were set up in three neighbouring places, Pilimung, Double Mountain 8,000 to 9,000 feet high, and Baiune; these posts were four to five hours apart. Another jeephead post was placed at Powerhouse. The more remote areas, such as Markham, were centres for patrolling, and these less concentrated military activities were adequately cared for by a medical officer in the Partep area, and by "roving" orderlies who were available according to needs. Though native porters could not be used at all prodigally on this difficult line of communication, they were invaluable, and great assistance in their management was given by the personnel of Angau. Even a brief perusal of these arrangements shows how the medical needs were assessed by the time-distance factor not only in the evacuation of sick and wounded, but also their prompt treatment; both demanded a liberal hand in the provision of medical officers, supplies and posts. The earlier experiences of Refshauge and Smibert had demonstrated this: Saxby, as A.D.M.S., acted on the same principle, and Disher, D.D.M.S. of New Guinea Force, was

as liberal as possible in supplying medical officers. Allowance was made for adequate attention to be given to the sick and wounded at points not too far apart and without placing undue strain on transport.

The foot tracks varied greatly; carrying over some of them was a very burdensome task, as it was on the Owen Stanley Range. A jeep track was being made from Wau through to the Summit camp, but, to anticipate its history, it was not a success, and broke down in heavy rain. The trail from Powerhouse climbed to 9,000 feet before it fell steeply to Pilimung and Missim through cold wet rain forest. It was barely possible to carry stretchers over this rough muddy track, described by some as the hardest trail in New Guinea. Some of the tracks were passable enough to warrant the carrier teams bringing back supplies on the return journey, but not all were like this. On the Mubo line of communication the two stages from Mango to Skindewai, where the main staging post held fifty beds, were each a hard day's carry requiring twelve boys to a stretcher, too heavy to warrant back-loading of the native teams. From the Guadagasal area to Nassau Bay, on the coast, the trail was mountainous, with some hard climbs. On the track to Mubo, *en route* to Komiatum, the going was reasonable for the type of country. Off these main tracks, however, some of the bases later established were reached only after journeys which were very trying for carrier teams. The Wau-Bulolo section was much easier than these forward areas; the climate was mild and the tracks ran through open timbered country at an elevation seldom greater than 3,500 feet. From Sunshine to the Markham River was a long hard carry, but it was not so exacting as to preclude the use of stretcher teams for patients. For the maintenance of an adequate service in these serial posts several factors were necessary besides a liberal establishment of medical officers and orderlies. These were the regular issues of rations and supplies, usually dropped from the air, allowing adequate provision for expansion or movement of the sites forward or back in accordance with the military position. The establishment of the divisional rest station at Kaindi in the Wau area helped greatly to lessen the strain on other posts; it was now able to care for 100 patients with slight ailments during convalescence.

The nature of the problems in hand showed that the only satisfactory solution would be an elastic organisation capable of following shifting battlefronts, and demanding a high degree of versatility from the medical personnel.

Geneva Emblem. During June a strong protest was made by the medical services against an official direction to remove red crosses from the main dressing station. While the A.D.M.S. and his colleagues recognised that either adequate display of the Geneva emblems or concealment was permissible for a medical unit, they pointed out that the sudden removal of emblems which had been displayed for several months would encourage the enemy to believe that the site was no longer occupied by a medical unit. Further, Refshauge maintained that facilities were better in the M.D.S. as then sited, and that there was good evidence that the Japanese had regard for the Geneva emblem.



Wau-Salamaua

PREPARATIONS FOR RENEWED ACTION

During the latter part of June attacks were expected by the Australians in the Mubo area. Saxby estimated the additional medical support required as surgical teams, remaining rear details of the 2/2nd Field Ambulance, and the 15th Field Ambulance. Transport difficulties delayed their moves, but "A" and "B" Companies of the 15th Ambulance and the balance of the 2/2nd Ambulance arrived, and the 2/1st Mobile Operating Unit replaced a surgical team. A little later, part of the headquarters of the 15th Field Ambulance also arrived. The appointment of S.M.Os. to the two brigades simplified administration and control. The medical arrangements were by now well forward, though there was still some shortage of reserve supplies. It was recognised that air-dropping could not always be entirely regular, for calls on transport planes were great, and other missions had important claims, but on the 30th, the day when enemy activity flared up again in the Mubo area, the M.D.S. at Wau was almost destitute of medical stores and liquid fuel, and had very little food. To keep the forward posts supplied was no light task, for these really constituted a chain of small hospitals, with an ability to expand quickly when need arose.

ACTION ON THE RIDGES

At the end of June the 15th Brigade, under Brigadier H. H. Hammer, moved eastward from the Missim area, and with the 58th/59th Battalion launched an attack on the high ground posts at Old Vickers, Coconuts and Bobdubi. This movement was designed to synchronise with a landing on the coast to the south by a United States force.

Landing at Nassau Bay. To this end preparations were being made; at Nassau Bay "D" Company of the 2/6th Australian Infantry Battalion was to give support. On 30th June the first wave of a United States force landed at Nassau Bay. In this early landing operation difficulties were met which caused trouble in timing the movements as planned. The weather was bad and the sea rough; the barges were insufficient in number, the troops were inexperienced and were unable at first to achieve cohesion, while the land party had trouble in crossing the Tabali River and the adjoining swamp. The 2/6th Battalion contrived to consolidate as a supporting force on 1st July, near the mouth of the Bitoi River. Under more favourable conditions further landings of American barges were made on the 3rd, which was reasonably close to the original date for landings on Woodlark and Kiriwina Islands.

The Japanese in the coastal areas were far from inert, and had shown increased hostility during the past two weeks, both by attacks on the 2/6th Battalion, and by heavy bombing of the area. Some heavy assaults were beaten off before the landing took place, and little damage was suffered by the supporting troops, though the attached native carrier force was scattered for several days. By the sixth day after the landing three American companies were ashore with some guns and supplies. Australian troops had provided some cover for the American landing, and the

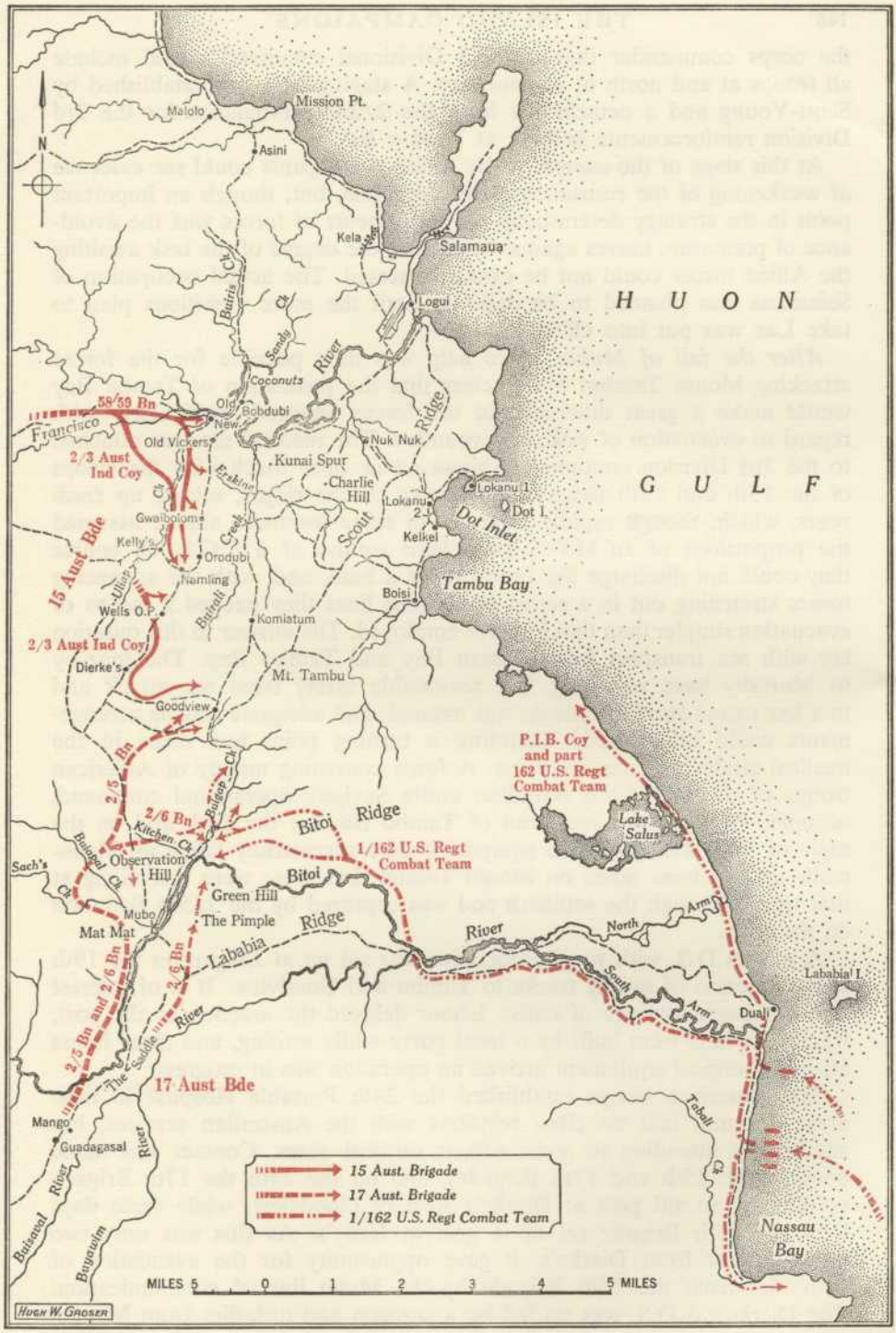
Australian medical services were prepared to give attention to sick and wounded until the landing force was established.

While consolidation of the United States I/162nd Battalion (known as MacKechnie Force) was taking place at Nassau Bay, successful diversions of the Japanese by the Australians were taking place on the high ground inland. The 58th/59th Battalion made a wide attack on Bobdubi Ridge, and carried out an ambush on 3rd July. Growing air strength was used to supplement attacks on objectives in the Mubo Valley, and the organised American force had reached Bitoi Ridge on 8th July. The Australian 2/6th Battalion attacked Observation Hill, and was approaching the American force. The Australians were using their familiar method of aggressive patrols which had proved so effective in this country, and were supported by the American field artillery.

The 17th Brigade at Mubo. While sea-land bases were being set up on the coast south of Salamaua, the Australian position on the heights above Mubo was being greatly strengthened. The number of Japanese in the forward area was being reduced and their retreat was blocked. New posts were set up to deal with the forward problems in the 17th Brigade area. Quinn set up his R.A.P. for the 2/6th Battalion at Sach's Creek; at Mat Mat staging post patients could be given necessary care, which included not merely ordinary comfort and hot drinks, but even resuscitation by intravenous infusion. Complete control of Observation Hill was not gained by the 17th Brigade troops for some days after the southern slopes were taken, and during this period sick and wounded had to be carried to a staging post at Reeves' post. Here they rested for the night, looked after by a medical officer and a medical orderly until they could go on to the well-equipped Mango A.D.S. This organisation was transferred to Goodview Junction as soon as a direct route was open.

On the 12th the Australians took the Pimple and moved on to take Green Hill and the Mubo aerodrome, which promised to be extremely useful when made practicable for use by light aircraft. During these attacks special medical arrangements were made at Lababia, but these were not needed, for after initial resistance at these points the enemy withdrew. The following day troops of the 17th Brigade moved past Observation Hill to the north, where they came into contact with elements of the 15th Brigade at Goodview Junction. Old Vickers on the heights was still strongly defended, and resisted the 58th/59th Battalion, though farther south the 2/3rd Independent Company had some success. Farther north in the Markham area the 24th Battalion patrolled actively against the Japanese troops deployed towards Salamaua.

Medical arrangements at this period followed the requirements of the actions. After the initial periods of the landing at Nassau Bay medical attention to the American force was supplied by the American medical corps, and thus, although members of the Australian medical services gave needed treatment to American troops, they had no general responsibility to the main forces. Difficulties arose between the United States and Australian force command, but these were overcome by a direction of



The 3rd Division attack, 13th July

the corps commander that the 3rd Divisional command would include all troops at and north of Nassau Bay. A staging post was established by Scott-Young and a detachment from the 2/2nd Ambulance for the 3rd Division reinforcements landing at Nassau Bay.

At this stage of the campaign the Allied participants could see evidence of weakening of the resistance of the Japanese, but, though an important point in the strategy determining the movements of forces was the avoidance of premature moves against Salamaua, the degree of the task awaiting the Allied forces could not be exactly assessed. The actual occupation of Salamaua was planned to be deferred until the more ambitious plan to take Lae was put into effect.

After the fall of Mubo. More help was now possible for the forces attacking Mount Tambu; it was clear that the possession of Tambu Bay would make a great difference to the forces engaged, particularly with regard to evacuation of sick and wounded. The medical services attached to the 3rd Division continued to press on in close touch with the troops of the 15th and 17th Brigades advancing on the ridges, setting up fresh posts, which, though rapidly built-up, in some instances almost assumed the proportions of an M.D.S. or a light section of a C.C.S. Of course they could not discharge the functions of a base, and, with the advancing forces stretching out in a series of tenuous lines they needed a means of evacuation simpler than that hitherto employed. The answer to this question lay with sea transport from Nassau Bay and Tambu Bay. The journey to Moresby base was long, but reasonable safety from sea attack and to a less extent from air attack, was assured, and adequate staging arrangements could be devised. Therefore a turning point had come in the medical strategy of the campaign. A force consisting mainly of American troops of the III/162nd Battalion under Savige's operational command, occupied the southern headland of Tambu Bay on the 17th and on the night of 20th/21st guns and equipment were successfully taken in. Meanwhile attacks were made on Mount Tambu, but these were unavailing at that time, although the southern end was captured by the 2/5th Battalion on the 16th.

A new A.D.S. with surgical facilities was set up at Buigap on the 19th at the junction of supply tracks to Tambu and Goodview. It is of interest that, although shortage of native labour delayed the erection of the post, frames for huts were built by a local party while waiting, and three hours after the surgical equipment arrived an operation was in progress.

The American troops established the 24th Portable Hospital in their area; this unit had no close relations with the Australian services, but assisted by attending to some urgent surgical cases. Contact was made between the 15th and 17th Brigades, and on the 24th the 17th Brigade established an aid post at Dierke's west of Goodview, while three days later the 15th Brigade set up a post at Kelly's. As this was only two hours distant from Dierke's, it gave opportunity for the evacuation of casualties from the 15th Brigade by the Mubo line of communication. The Dierke's A.D.S. was staffed by a surgeon and orderlies from Mango,

and after delays in the receipt of cover and bedding, which were brought up by carrier train, work began. By keeping a squad of fourteen natives at Dierke's and two squads at Buigap one stretcher could be taken daily to Mango from each A.D.S.

The I/162nd United States Battalion took over the Tambu area from the 2/5th Australian Battalion, and the 24th United States Portable Hospital moved up near the Buigap A.D.S. with two more native bearer squads. As many as fifteen stretchers were in use in these two posts in dealing with the casualties. The carrying time from Buigap to House Mango was three and a half hours. Stretcher carriage from Mango to Summit was satisfactory, and an improved track allowed back-loading to be used. If a patient needed urgent treatment overnight he could be taken on direct to Skindewai. Meanwhile, work was proceeding on the Mubo aerodrome and the use of an ambulance plane from this airfield was in sight by early in August.

Meanwhile the 15th Australian Brigade, answering a Japanese assault on Orodubi, attacked Bobdubi Ridge. On the 28th the 58th/59th Battalion took Old Vickers in the same mountain area, and covered the Bobdubi-Komiatum track.

Air transport from Mubo. The Mubo aerodrome was ready for traffic on 10th August and a plane landed and took off successfully. It could carry one lying and one sitting patient, and by making an early start in the morning before the weather thickened and reduced visibility, could make five daily trips to Wau. On Mubo Ridge there was a small post of twelve beds; from here patients were sent to Mubo aerodrome by stretcher teams if these were available, or by walking if they were able. Some medical personnel also came in to Mubo by air, and medical and Red Cross supplies were brought in 20-pound loads from Wau. These were of convenient size for sending by carriers who took patients from Goodview to Mubo. This evacuation route could only deal with small numbers, but was most valuable for men whose condition demanded early treatment at a base area. At this stage an increasing flow of traffic began by barge.

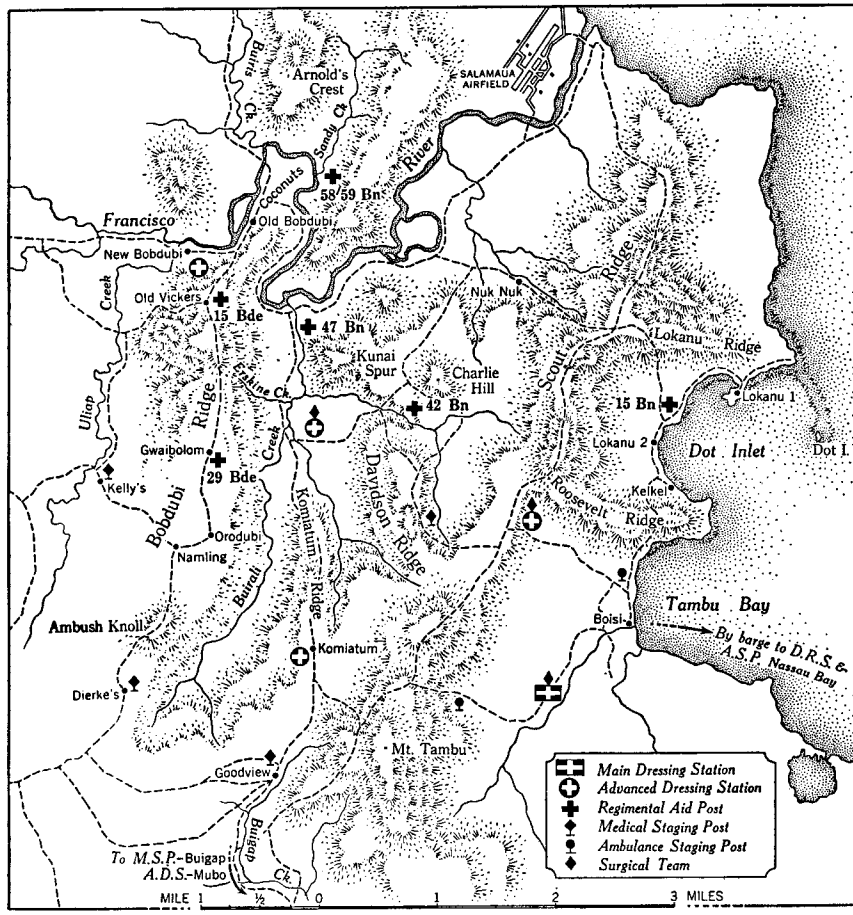
Early in August there was considerable fighting around Komiatum, and the enemy line of communication was cut and held. Troops of the 17th Brigade attacked Komiatum on the 16th, and the 29th Brigade, added to the 3rd Divisional force, had its 42nd Battalion also in action.

After overcoming enemy resistance at Goodview Junction the 2/5th Battalion proceeded northwards on the 19th and met the 2/6th Battalion at Komiatum. They continued along the Komiatum track and exerted pressure on the withdrawing enemy. Two days later Australian forces drove the Japanese from the Komiatum-Bobdubi-Salamaua track; this followed the plan by which the enemy would be driven north from his vantage points without a definite attack on Salamaua itself.

The American force had occupied Mount Tambu on the 19th. Here, their objectives were limited by the terrain, in which "the precipitous razor-backed ridges and high isolated features of Mount Tambu made frontal attacks against a strong enemy impracticable".

MEDICAL AND SURGICAL FACILITIES

During August, action continued in the Missim area, and an increasing number of casualties called for prompt transport arrangements and greater facilities for forward surgery. The increase in surgical work was illustrated by the progress of the mobile operating unit, which, without being invested with all the equipment designed to make such a unit independent, was



Wau-Salamaua dispositions

moved to areas where it was most needed. During July it had worked at the A.D.S. at Missim, which had been taken over by the 15th Field Ambulance, and after moving to Meares' Creek three hours away, left a detachment behind to deal with other casualties. The team then moved to A.D.S. Kelly's just in time to start work as casualties arrived. By 24th August they had treated 123 surgical cases, chiefly men wounded in the assaults on Vickers Ridge, Bobdubi and the Namling and Orodubi

areas. The numbers treated were a reflex of the bitter fighting in these areas. Captain R. K. Constable, who had remained at Missim, now took over at Kelly's and the "light team" of the operating unit moved to the post at Bobdubi. This brought the surgeons closer to their work, and obviated a carry up the Uliap Creek by night. This work concluded, Constable took his team with the advancing force down the Francisco River, and up Sandy Creek towards Salamaua.

The A.D.S. at Kelly's rose rapidly in importance, and for most of the time had 120 beds. Until 23rd August the staff included two surgeons, two medical officers, one dental officer and thirty-five O.Rs. Later one surgeon and several O.Rs. were sent to establish a medical staging post at Bobdubi, which, like Nunn's post, had over twenty beds. At Missim the A.D.S. had fifty beds, with one medical officer, and another staging post was opened at Hote with fourteen beds. The 15th Field Ambulance found it convenient to use the R.A.P. of the 58th/59th Battalion as a staging post, to which an additional medical officer was attached.

Unit natives collected wounded in front of the aid post, and native bearers allotted to the battalion carried stretchers; twelve bearers were needed in hilly country and eight in flat. The average time elapsing from wounding to operation was eight hours, and the minimum five hours. Occasionally men were missing for much longer periods, from thirty-six to ninety-six hours: these figures are excluded from the above averages. When the Bobdubi post was established these figures were greatly improved, the average falling to five hours. Admittedly in certain areas where natives were not being used for supplies the carrier system was wasteful, but later one stretcher per day, the initial rate, was increased to four per day. At the end of August a still shorter line of evacuation was possible, through A.D.S. Erskine, though only four stretcher cases a day could be handled by the post. Sometimes during this phase of the campaign stretchers would accumulate, especially at Kelly's, where at one time thirty-six were waiting forward movement. This forced the evacuation of convalescing patients who would have been able to return direct to their units had a further period of rest been possible. During the period 4th to 31st August the medical establishments varied in number and strength according to need. Medical evacuation was carried out over a line of communication not much otherwise used; this rather enhanced the difficulty of handling casualties. Refshauge reported that he considered that the increasing fatigue of the troops caused lack of vigilance, and suggested that this might have been responsible for a greater proportion of severe injuries necessitating movement by stretcher.

Medical supplies for Bobdubi were usually dropped by air at Nunn's post; but later arrangements were made to drop at Bobdubi. At times there was an embarrassing shortage of some essential medical stores; this was due to an increase in the general sick rate, as well as in battle casualties, to occasional delay in dropping of supplies, and also to some extent to the lack of a dispenser in the area who could have been usefully engaged in checking and forecasting the local needs. Rations were fairly

satisfactory, but it was hard to provide comfort or variety for sick men.

The medical services took the opportunity to estimate the physical condition of the troops to find out how they had stood up to the trials of two months' campaigning. The general health of the men could be fairly assessed from studying them over a period as they passed through the posts: medical officers described it as "only fair". There were signs of fatigue to be seen, to which Savige had also drawn attention in his reports. More important than these factors were the sick rates due to infective conditions and the growing incidence of disorders of the skin. These latter were not altogether preventible, but malaria and typhus could be controlled in part, yet they were rising in frequency.

ADDITIONAL TROOPS ARRIVE

The headquarters of the 3rd Division was now due for relief; a wider strategy was centring on Nadzab and Lae, and the men were tired by their successful efforts of past months. The 29th Brigade, comprising the 15th, 42nd and 47th Battalions, began to land at Nassau Bay, and on the 24th August relieved the 17th Brigade. On the 26th the 5th Australian Division headquarters took over from the headquarters of the 3rd Division. After some weeks of attack the American force took Roosevelt Ridge overlooking the northern end of Tambu Bay and Dot Inlet on the 29th. Two days later the 47th Australian Battalion took Kunai Spur, an inland ridge rising from the long Scout Ridge in a bend of the Francisco River.

MEDICAL ORGANISATION AT NASSAU AND TAMBU

In addition to these highlights in a series of actions which were steadily pushing the Japanese back, and lessening the value to them of Salamaua as an active base, work was done in consolidating the coastal areas now held by the Allied forces. These bases were of great value not only as future stepping stones, but also as inward channels of supply and outward channels for sick and wounded. Once the Tambu Bay line of communication was safe it could be used to send patients from the Mount Tambu area by barge down the coast to Morobe, though greater facilities for medical care were wanted at the loading points. After Goodview Junction and Mount Tambu had been captured the way was clear to Tambu Bay, and evacuation of sick and wounded through Wau ceased altogether.

When the 42nd Battalion came under command in this area a light section of the 7th Field Ambulance was attached, and formed a medical post at Boisi on Tambu Bay. From this beachhead barges took patients to Nassau Bay, where there was a jeephead with a surgical post, but this could not go farther forward owing to problems of water supply. No surgeon was sent with the 42nd Battalion, and as the chief surgeon of the American force in Tambu seemed doubtful about supplying an emergency service to this battalion, an Australian surgeon was sent from Goodview with equipment and staff from the 7th Field Ambulance at Nassau.

The main body of the 7th Ambulance had arrived at Nassau Bay on 10th August, when a section began to set up on the foreshores of

Tambu Bay under Major J. A. Hill. This beach was exposed to shell and mortar fire, as it was only one-third of a mile from a ridge still held by the Japanese. The post was consequently well dug in. Lieut-Colonel S. D. Meares, the ambulance commander, brought up a surgical team to Tambu Bay, and finally selected sites for both an A.D.S. and the operating team. A week later the A.D.S. was opened at Tambu, and entered on a period of service lasting some two months under Major W. V. Connor. On the 14th Meares and a surgical team with Major Hill, Captains W. S. L. Stening and G. H. Solomon left Nassau Bay and selected sites at Tambu Bay for an A.D.S. and a surgical team. It was also found necessary to keep staging posts on the beach at Tambu Bay and to the north at Dot Inlet so as to ensure care of the sick in transit. By the 17th these arrangements were complete. The 7th Ambulance established an A.D.S. at Erskine on the 26th, about two miles inland from Tambu; here again the position was exposed to enemy attack, though the site was an excellent one, on a high flat mound, with covering bamboo alongside a stream. It was on the line of communication from the 47th Battalion near the winding Francisco River: seaward from the 42nd Battalion was another post, A.D.S. Green. Here a post was opened later on 7th September to treat and stage casualties. This was one of the few sites where water was not readily accessible: here it could only be reached down a steep declivity. An M.D.S. was established at North Tambu, also with a surgical team.

The 9th Field Ambulance also supplied medical cover for Nassau Bay. Major P. G. Heffernan took a light section of this unit to set up an aid post for use during the American landings, and here this detachment worked with help from the 2/2nd Field Ambulance until after the 17th Brigade had left the area.

A still wider-flung distribution of medical work was that farther north in the Markham area where the establishment of covering airfields at Bena Bena and elsewhere were foreshadowed, as part of the coming battle for Lae. A medical staging post was also maintained at Sunshine, and at other advanced posts such as Mumeng and Partep 2. These moves extended the zone of active preventive medicine, for the increasing importance of endemic diseases and the problems of their control were evident in viewing their expansions, particularly in anti-malarial work.

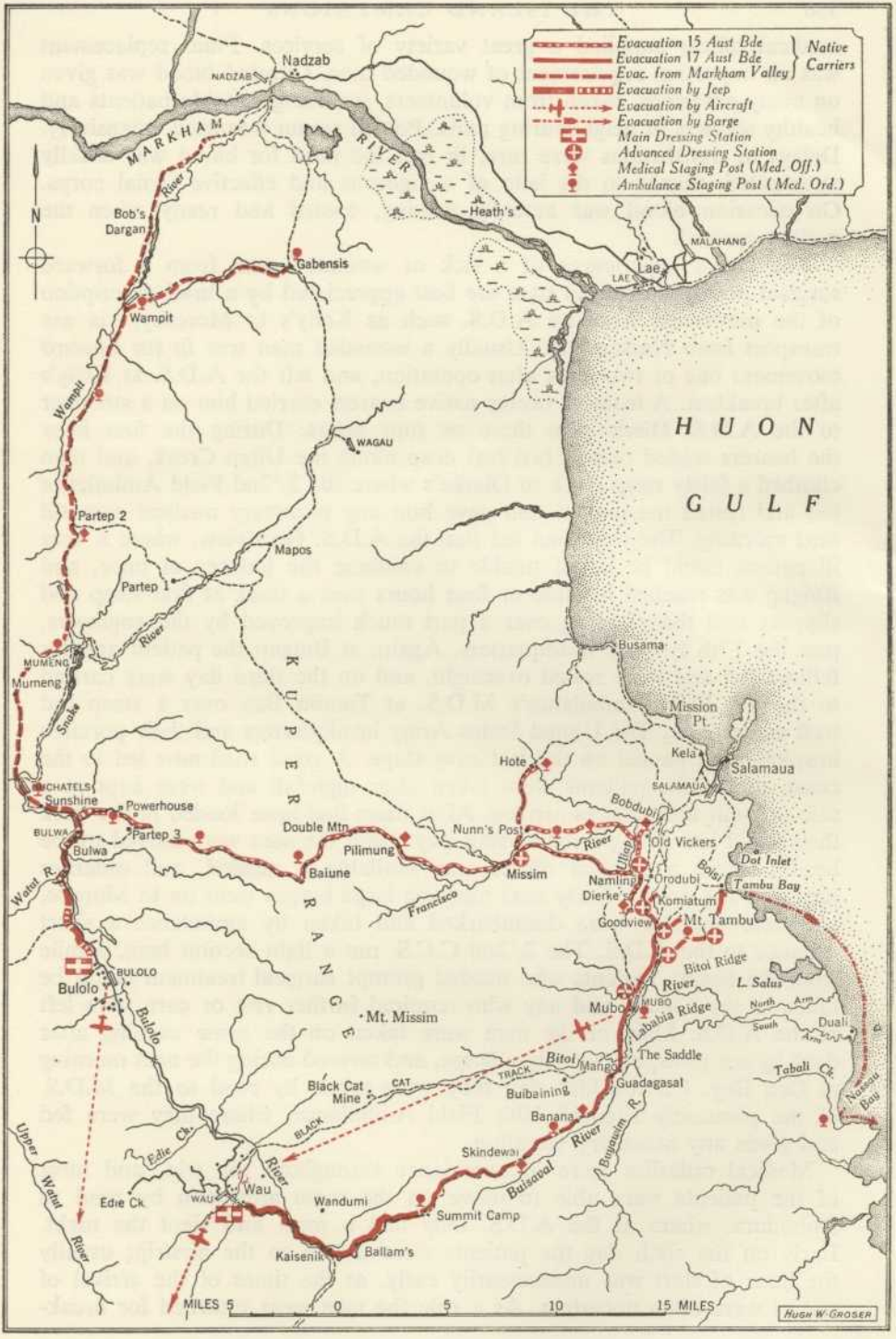
WORK OF MEDICAL POSTS IN JULY AND AUGUST

The medical and surgical posts were planned to conform to the particular type of warfare in which only frequent staging posts could make reasonable handling of sick and wounded possible. Indeed some of the patients, such as those suffering from severe typhus, might be better kept in a stationary post for brief rest and care than to be exposed to another trying journey. The A.D.S. and the operating centre were placed at the most secure forward area where casualties could usually be seen by the surgeon within twenty-four hours. Other posts not equipped for surgical work could hold minor sick from the more forward units, or keep men long enough to make it possible for them to walk back. Orderlies were

able to maintain staging camps holding six to twelve beds. In areas possessing such stability as could be given by the presence of a battalion even if only in part strength, a light section of a field ambulance could carry out these tasks admirably, and could also support a medical officer able to do surgery. The expansions of some of these posts were remarkable. In anticipation of the needs of the operations in July, the Wau M.D.S. had increased its beds to 200, and the Bulolo A.D.S. to 80 beds, but even these tasks were not so exacting as the work involved in expanding some of the more remote and extemporised aid posts often sited in virgin jungle. Transport was always a vital factor. For instance, when the jeephead of the Mubo track was moved to Summit camp, Ballam's post could be closed, and Skindewai then expanded to 80 beds. Mango post, twice bombed, was re-sited in a safer place, where its capacity was increased to 50 and later to 120 beds. Here two surgical teams were employed, with facilities for simultaneous operating. The small posts in which minor and major measures of resuscitation were carried out have been mentioned: from these patients were sent on to larger centres as soon as wisdom and security dictated.

In general the facilities were greater than on the Owen Stanleys, as, despite the very rough nature of the Wau-Salamaua country, medical officers and orderlies could be brought up nearer the actual front line with the same or less expenditure of time and energy. Logistic problems had been brought nearer solution by improvement in supplies, by greater experience of packaging and by practical experience in air-dropping, both with and without parachutes. Some of the trails were less formidable than those traversed in the earlier campaign, but others were exceedingly rough and primitive. Distances were still measured by time, and wounded men's chances were often favoured by the brief period elapsing before they arrived at a surgical post. The establishment and maintenance of a series of fresh posts in response to tactical demands could not have been accomplished without a liberal hand in providing men and supplies. Among the necessary supplies tools deserve a special mention: without these, even the materials at hand in the jungle were of little use.

Many of the aid posts were reached by narrow jungle trails often passing through streams for considerable distances. The staging post was a combatant responsibility, but the medical services were concerned with its site and convenience, its water supply, its hygiene, and its facilities for supply by aircraft, remembering that most of this was done by free dropping. Near the staging post was a medical post usually run by members of a field ambulance. Orderlies stationed in intermediate posts were competent to look after patients, adjust dressings and give morphine. They could be trained to give intravenous injections and anaesthetics under supervision, and to acquire knowledge of operating room technique, including application of plaster and splints. All this required considerable versatility, but well-chosen men again proved that it was within their capacity. Naturally supervision by a medical officer was desirable, but this was not always possible. Some of the smaller posts with a peripatetic



Wau-Salamaua general line of evacuation

medical officer supplied a great variety of services. Fluid replacement was an important requirement of wounded men. Citrated blood was given on many occasions, taken from volunteers, including suitable patients and healthy soldiers in neighbouring units. Pooled serum was used extensively. Delays in transfusions were rare, in fact the need for blood was usually anticipated, thanks to the help of a vigorous and effective signal corps. On occasion blood was actually waiting, cooled and ready when the patient arrived.

The actual experiences of a sick or wounded man from a forward surgical post to a hospital base are best appreciated by a brief description of the movement from an A.D.S. such as Kelly's to Moresby, via sea transport from Nassau Bay. Usually a wounded man was fit for onward movement one or two days after operation, and left the A.D.S. at Kelly's after breakfast. A team of twelve native bearers carried him on a stretcher to the A.D.S. Dierke's in three or four hours. During the first hour the bearers waded one to two feet deep along the Uliap Creek, and then climbed a fairly steep track to Dierke's where the 2/2nd Field Ambulance fed and rested the patient and gave him any necessary medical care till next morning. The trail then led past the A.D.S. Goodview, where a very ill patient could be left if unable to continue the journey at once, and Buigap was reached in three or four hours over a track at first steep and slippery and then leading over a part much improved by the engineers, past the 17th Brigade headquarters. Again, at Buigap the patient and his fellows fed and were rested overnight, and on the third day were carried to the 7th Field Ambulance's M.D.S. at Tambu Bay over a steep but well made track. The United States Army headquarters and their portable hospital were passed on the last easy stage. A good road now led to the coast, where the patients were taken after nightfall and were kept in a safe dug-out until barges arrived. After these had been loaded in the dark they sailed late at night for Nassau Bay. Here the men were moved to the beach, where a medical officer was available if needed, and orderlies provided hot drinks. Early next morning large barges went on to Morobe, and here the sick were disembarked and taken by ambulance a short distance to the A.D.S. The 2/2nd C.C.S. ran a light section here, a mile from the beach. Patients who needed prompt surgical treatment could be taken to the C.C.S., and any who required further rest or care were left at the A.D.S. Most of the men were taken on the same evening after dusk by sea transport, usually a barge, and arrived during the next morning at Oro Bay. On the fifth day they were taken by road to the M.D.S. of the pleasantly situated 10th Field Ambulance, where they were fed and given any necessary attention.

Medical orderlies were in attendance throughout the trip, and most of the patients were able to move on the same afternoon by road to Dobodura, where at the A.D.S. they had a meal and slept the night. Early on the sixth day the patients were driven to the airstrip; usually the hour of start was unnecessarily early, as the times of the arrival of planes were often uncertain. As a rule the men were returned for break-

fast, and did not leave the ground till the morning was well advanced. There now remained only a brief air trip over the range in transport aircraft, and early afternoon saw them in Moresby. Ambulances took them to hospital and the long journey was over, unless their condition warranted return to the mainland by hospital ship, sea ambulance transport or aeroplane.

During the last phases of the Salamaua campaign the only essential differences in the work of forward posts were those of administration, owing chiefly, as we have seen, to the changes in the military position which permitted the use of sea transport. The Tambu A.D.S. thus became the clearing house for the 15th and 29th Brigade areas. The 47th Battalion troops were sent there through the Komiatum staging post, and those from the 42nd Battalion were passed through a single stage from the Davidson A.D.S. This post differed from most of those on higher ground: its water supply was drawn from a deep gully, which influenced the siting of the post. The theatre was floored by timber fashioned like railway sleepers.

CAPTURE OF SALAMAUA

Early in September the work eased, as the phase of attack on the Japanese gave way to a brief period of exploitation and then to one of pursuit. These changes accompanied and followed the events associated with the operations against Lae. It has been pointed out earlier that the capture of Salamaua was evolved as part of the major strategy which comprised the establishment of airfields, and the possession of bases on the north coast, beginning with Lae. The operation for the capture of Lae was begun on 4th September,[1] and after this move was made there was no longer any reason for delaying an advance on Salamaua. The alteration in medical tactics followed the military movements, and as the phase of pursuit of the Japanese south of the Francisco River began, so the need for a number of the advanced medical posts disappeared. The capture of Charlie Hill enabled Allied troops to clear the enemy from Scout Ridge and to sweep across from the already captured Kunai Spur to the river. The 15th Battalion overcame Japanese resistance on the coast, and by threatening their rear line drove them from the area south of the river.

The succeeding Allied advance permitted the 29th Brigade to push forward to the Salamaua airstrip just across the flooded Francisco. The 42nd and 47th Battalions successfully crossed the river, the isthmus, which is a topographical feature of Salamaua, was occupied by a platoon of the 42nd Battalion on 11th September, and also Kela along the coast to the north. The previous day the S.M.O. of the area accompanied the second forward company when they crossed the Francisco, to look for a building suitable for a surgical team. On the 11th Captain R. W. Klein and a surgical team moved forward to Chinatown, Salamaua, so as to be in readiness, but the pursuit was too rapid for the selected site to

[1] These operations are described in Chapter 9.

be used. Other points to the north had fallen on the 13th, and on the 18th the 15th Brigade met part of the 24th Battalion which had been engaged in the Markham Valley. Salamaua was no longer a significant position to the Japanese: even before Lae fell the Wau-Salamaua campaign had ended, and preparations were under way for fresh operations in the Huon Peninsula and the Ramu Valley.[2]

MEDICAL REVIEW OF THE CAMPAIGN

NUTRITION

During the first period of the Wau-Salamaua campaign attention was given to evidences of impaired nutrition in the troops engaged in the Wau-Bulolo Valley and along the lines of communication. A group of twenty cases of beriberi was reported; these were not severe, but attracted notice because it was thought that a certain degree of debility seen in many other men might perhaps be partly due to a deficiency of the *B* complex. Routine survey showed that malarial anaemia was not the cause; malaria was not an important hazard on the goldfields. At first it was thought that the proportion of men with some degree of vitamin deficiency might reach as high as 50 per cent, but this figure was probably an exaggerated estimate based on vague clinical evidence. Rest and appropriate diet soon restored these men to health.

In the ensuing campaigns the position with regard to nutrition improved owing to two factors: a better operational dietary of more adequate nature and content, and extended facilities for aerial dropping of supplies. In some places the diet could be supplemented by fresh fruit. From Bulolo to Sunshine pawpaw trees grew along the road, and other gardens furnished citrus fruits and sweet potatoes. The great increase in facilities for air-dropping of supplies is well illustrated by the fact that at one time in February 1943 the R.A.A.F. unit at Wau had only three parachutes, whereas six months later there were huge dumps of parachutes round the Mubo area which could not be economically collected.

Since the question of dietetic malnutrition had been pointedly raised, greater emphasis was laid on the question of supplies and rations. Reliance could not be placed on carrier trains to maintain supplies: the numbers were insufficient, and illness among the natives was not infrequent, especially as the lines of communications stretched out more and more. On occasion loss of equipment occurred, as for instance in one action of the 2/3rd Independent Company with the Japanese, when practically the whole of the unit's medical equipment and stores was lost. Air-dropping provided the answer: when its use was extended from ammunition and general supplies to medical stores the position was greatly improved. Certain material was nearly always scarce, for example, hygiene stores, but others, such as medical comforts, were obtainable in useful quantities. The Army Service Corps helped greatly in providing these dietary sup-

[2] Australian casualties Wau-Salamaua 22nd April-11th Sept 43: killed in action 33 officers, 316 other ranks; wounded in action 54 officers, 700 other ranks.

plements, especially extra sugar, tea, milk, coffee and tomato juice. Custard powder, wheatmeal and dehydrated fruit were valuable additions to the diets of medical posts.

Early in 1943 when the rehabilitation and training ground of the Atherton Tableland was in full swing, a general appraisal of the health and nutrition of the hard worked troops was more easily made. Practical trial showed that the physical state of these young veterans was unimpaired, and once the lingering traces of malarial infection were removed, good feeding and disciplined exercise restored the men to health, ready to meet whatever tasks awaited them in the future.

ENDEMIC DISEASES

Endemic infections other than malaria did not prove serious wasters of men, as many such conditions did not cause sustained illness. There were of course other significant avenues of loss in addition to malaria. Scrub typhus was not statistically serious, but it was always potentially dangerous in the individual. Prompt evacuation of patients in the early stages of typhus posed a problem both of diagnosis and of transport. Local and personal preventive measures, stimulated in the later phases of the campaign by the work of McCulloch and his colleagues, were effective and had a valuable educational influence.

The introduction of an efficient "miticide" was an important step. Dibutyl phthalate ("Betty") was chosen by the Australian Army on account of its persistence in fabric, even after washing. It was also felt that it was wiser not to use dimethyl phthalate ("Mary") for typhus prevention in spite of its known potency, as there was a possibility that it might be used by the troops more for typhus prevention than the really more important prevention of malaria for which it was intended. Clearing the kunai grass from the perimeter of camps and avoiding camp areas infested by rats, possible animal vectors, were measures which appeared to lower the incidence of infection.

Diarrhoeal diseases were as usual a constant though not serious cause of disability, particularly in the more distant and isolated posts. The bacterial type of disease was not definitely demonstrated in most instances, but its clinical manifestations were those of a mild bacillary dysentery. Hygiene has been mentioned from time to time. The breakdowns which had early produced epidemics of diarrhoea and dysentery had been remedied by stricter supervision of units. Better facilities were possible in the later phases of the campaign, and fouling of the tracks was less in evidence.

Better provision was made for washing of clothes, but this did not help much in the control of the growing tide of skin affections which were appearing in the force in the form of tinea and impetigo, and other forms of infective lesions. The climate was in part responsible, and shortage of appropriate medical supplies made treatment difficult. In addition the ancient injunction of *primum non nocere* was not observed as closely as would have been wise. It must be admitted, however, that

the medical officer was hardly able to give that degree of rest, or ensure the frequent application of wet dressings which would have been desirable. Further the practice of dermatology in the jungle was not so favoured as in general hospitals, and even there the problems of the skin were still only partly solved at a much later date. However, a good deal was done by the introduction of a non-irritant treatment by Captain P. F. R. Brown, R.M.O. of the A.A.S.C. 3rd Division, who had special dermatological training, and who was sent by Refshauge from Missim to Kelly's at a later stage of the campaign, and demonstrated the value of simple saline dressings.

In the 15th Brigade, during the final operations in the Bobdubi region, Refshauge noted the increase in fevers in general, due in part to relapsing malaria, and infections, often of the skin. He thought that the increase in skin diseases was of multiple origin, and related to the continual wetness of clothing, with a lowering of personal hygiene, fatigue, and possibly some lack of vitamins.

One important problem was that of the diagnosis of febrile disease. As on all tropical fronts, there was need for pathological facilities, particularly to establish the diagnosis of malaria, the commonest cause of pyrexia. In operational areas the prevalence of illness temporarily designated as P.U.O. exceeded the occurrence of battle casualties. For example, Meares reported that the 7th Field Ambulance had treated 146 battle casualties during the last phase of the battle for Salamaua, while 443 sick were treated during the same period: of the battle casualties sixty-five were stretcher cases. Of ninety-two P.U.Os. fifty-seven were due to malaria and thirty-five of these were primary infections.

The advice and help of a physician were appreciated in the outposts as well as in the large dressing stations of the field ambulances. In May, Hutson relinquished the duties of a regional consultant through illness, and was replaced by Lieut-Colonel S. W. Williams. The presence of a temporary consultant in an area was found to be of definite value, quite apart from the work of the permanent medical and surgical consultants attached to the Land Headquarters.

Water supplies seldom raised difficulties in this country, though the usual abundance in the valleys was not always found at higher levels. Chlorination was only carried out when large streams were used as sources of supply: small rivulets were usually safe in mountain country, and it was sometimes possible to reticulate the water through bamboo pipes.

MALARIA CONTROL

As the thin lines of fighting men pushed along the ridges and followed the mountain trails from height to valley, malaria became the troops' chief disability. As they pressed on along the tortuous river beds towards the goal of the coast the danger increased. A particular hazard was associated with this constant change of elevation: the high wet ridges, colder and less agreeable to the anopheline vectors, presented less danger of infection by malaria than the valleys below. Further, relative immunity



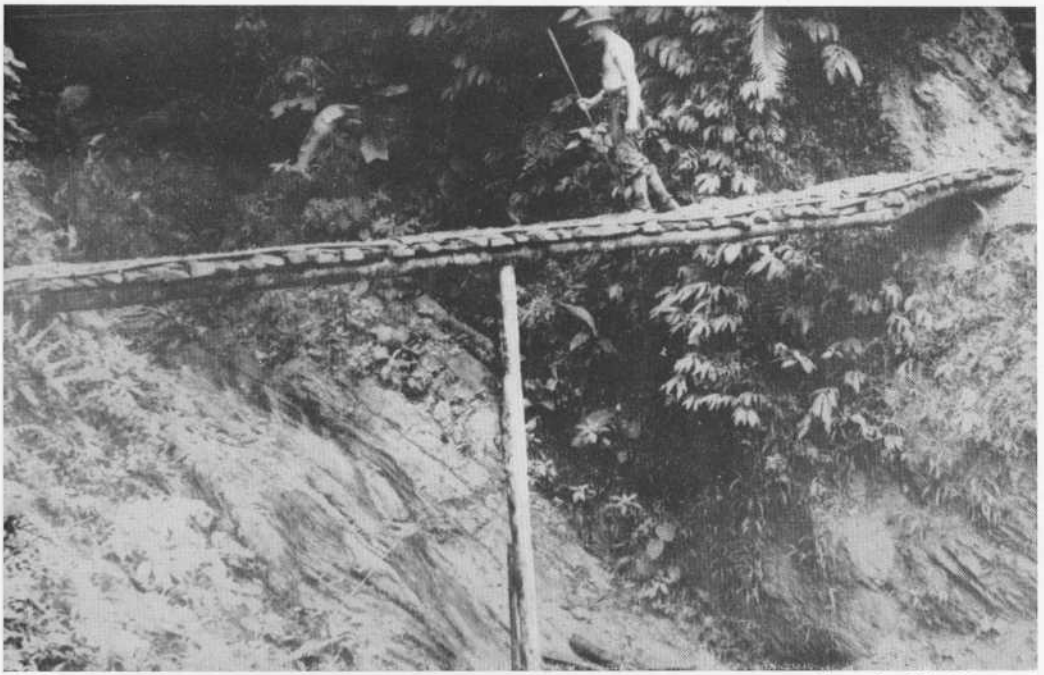
(Australian War Memorial)

Evacuation down the steep Boisi Ridge



(Australian War Memorial)

Native bearers carry a wounded soldier over a rough bridge across the Francisco River.



(Australian War Memorial)

Walking back from front line at Mount Tambu to the A.D.S. after being wounded. The bridge crosses a small gully which after heavy rain becomes a raging torrent.



(Australian War Memorial)

Typical country in the Wau-Mubo area.



The A.D.S. at Mount Tambu. *(Australian War Memorial)*



On the way to Lae. *(Australian War Memorial)*

on the high ground tended to make the men careless in the hot steamy valleys. Most of the troops engaged had been previously in malarious areas, many of them at Milne Bay, and it was estimated that 70 per cent of the force had been infected. Therefore many of the attacks were relapses of benign tertian fever, and it was noted that men fatigued and weakened by a period of strenuous service in forward areas had a higher incidence of such attacks than those recuperating in the rest camp.

During the latter part of the Salamaua campaign, some figures, such as those quoted by the 7th Field Ambulance, suggested that malaria was more common than was always apparent. Relapses of infections contracted in other areas were responsible for numbers of individual attacks, but these were decreasing, owing in part to the superior suppressive action of atebrin. As previously pointed out, the lessened transmission rate associated with the high wet ridges would tend to lessen the overall rate, though transmission increased in the valleys.

As the centre of operations moved north it opened out other areas which called for consideration. Major T. M. Clouston, D.A.D.H. of the 3rd Division, after a visit to Tsili Tsili and the Watut district in July reported on the malarial position there. The area lay in a valley, and was low-lying and swampy. There were many mosquitoes, particularly of the culex variety, which bit during the day-time in shady areas; malarial vectors were also present, they were breeding locally and were active at night. This area was classed as hyperendemic and the chances of effecting physical control were somewhat remote, but personal protection was essential, and required augmented anti-malarial stores. Saxby agreed as to the risks, and estimated that a weekly rate of 3 per cent might be expected.

In a district of very different topographical type Major Fenner, malariologist to I Australian Corps, late in August made an appreciation of the coastal zone south of Salamaua, including Morobe, Nassau Bay and Tambu Bay. In the Tambu Bay area in particular anophelines were breeding extensively in creeks and jeep tracks, and there were many malaria-infected natives in the area. The presence of an Angau native camp in the middle of the military area enhanced the risk from this source. Personal protection was good here on the whole, though carelessness in clothing was noticed among troops in transit. The efforts of an efficient malaria control unit had helped to reduce the incidence rate.

In Morobe anti-malarial discipline was poor to the point of disregard of established rules: Brigadier H. G. Furnell drew up a strong directive to commanders as to their responsibilities. The frequency of dengue in Morobe was an indication of the failure of units to deal with breeding places. Eighty cases had occurred in a month, causing a loss of 450 man-days among a population of 1,000. In Nassau Bay discipline was fairly good, though many bad breaches were seen.

A little earlier than this, the measures taken by the 3rd Division had already reduced the weekly rate in the divisional areas from 24 per 1,000 per week to 10 per 1,000, with a later rise to 14 attributed to

heightened military activity. Furnell recommended further instruction of medical officers in the entomological and epidemiological aspects of malaria, and its accurate laboratory diagnosis. Burston had already drawn attention to the rising malarial rates in the Wau area, and the anxiety that this must cause. He had previously advised the D.D.M.S. to bring clearly before all commanders in the force their responsibility for seeing that appropriate discipline was maintained, if risks of a repetition of malarial losses in the Buna campaigns were to be avoided. The examples quoted illustrated the persistence and care in malaria control which would be needed in campaigns extending up the north coast, especially with the added risks of movement by land and air.

In the field more vigorous preventive measures were taken: these could be more thoroughly applied in the goldfield districts than in the wilder jungle areas. Stress was laid on methods of personal protection, and of these the most important was the taking of a suppressive. The general change from quinine to atebrin which had been made early in the year was without doubt an important advance, though at this time no really accurate mass studies had been made.

Six months earlier steps had been taken to ensure adequate supplies of drugs and other medical material urgently needed for the prevention of tropical diseases, in particular malaria. In September 1942 Blamey had sent an able and forceful technical commission consisting of Brigadier Fairley and Dr Adrien Albert to the United States of America and the United Kingdom, and in March 1943 this was followed by Mr B. Egan and Lieut-Colonel C. W. Ross, who had special knowledge and experience in problems of medical supplies. These delegations did much to ensure a constant flow of anti-malarial drugs and supplies from America to the Pacific island front.

In June a great idea was put into effect, the establishment of the Land Headquarters Malaria Research Unit. This unit carried out research in the laboratory and the field, set out to discover what therapeutic weapons were to hand, how effective these were and what was their mechanism of action, and also threw clear light on the vital processes of the causative parasites and their characteristics of transmission. It was not to be expected that the first fruits of this ambitious research would be gathered at once, nor was it suggested that practical enforcement of the established preventive measures would wait while their true scientific basis was established. Already experience at Milne Bay had shown how effective control of malaria could be if it was wholeheartedly enforced as a disciplinary measure by combatant units.

Other important steps had been taken to implement all useful methods of malarial control. Entomological units were set up to investigate in the field the scientific side of insect vectors of disease, and to enable their habits to be related to the technique of prevention.[3] To the personal methods of prevention was now added the use of dimethyl phthalate, a

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The establishment of entomological units is described in this Volume, Chapter 12, In Australia 1943-45.

really effective mosquito repellent lotion, much superior to the greasy and unpleasant substitute for Dover's cream hitherto in use. By June repellent lotion and atebrin were in fairly constant supply even under the most difficult conditions imposed by the terrain of eastern New Guinea. One form of propaganda which was found useful was the publishing of the weekly incidence figures of malaria in all units of the division. This helped to show what reduction could be made by the faithful application of preventive measures within each unit, and how problems of manpower were thereby affected.

A question which arose here was that of the use of nets in the forward areas. It was thought that nets were risky during patrol work and therefore they were not used regularly. Deterioration from the constant moisture was rapid, and replacements were not easily obtained. One of the questions raised in the United States by Fairley was that of mildew-proofing of nets, and a satisfactory standard was agreed upon for nets to be used in the South-West Pacific area. During June up to 180 cases of malaria per week occurred, but intensive efforts reduced this figure, and by the end of the quarter the number had been reduced to 80 per week.

Peterson summarised his experiences with malaria precautions in forward areas with the 2/7th Battalion:

> Owing to difficulties of distribution due to frequent moves, two or three platoons were without suppressive atebrin for several days (about three to five). Otherwise the atebrin discipline was good. From the start, although the men had orders to carry a net, there was a shortage of nets. I cannot say how much, but probably about 25 per cent of the men had no nets on arrival in the Mubo area. I complained about this, and over 500 nets were sent up and the deficiencies made good about the end of April. It still took a couple of weeks to get the men accustomed to malaria discipline again, however. There were many occasions, of course, when nets could not, in my opinion, be used—on fighting patrols, and when in action in trenches. But a more conscientious use of mosquito lotion and clothing discipline would probably have cut down the rate of infection appreciably. It must be remembered that on the coast near Duali is a hyperendemic area.
>
> Mosquito veils and gloves could not be obtained. In any case, whether picquets (in action) could see clearly enough with veils on is open to question. I should think gloves would interfere with the rapid and effective use of fire-arms.
>
> It may be worth mentioning that the men who must keep a close watch on malaria precautions in action in this type of country are platoon and section commanders, particularly the latter. The company commander cannot keep a watch on all his men—the section commander can. This, I think, is the main weak link as far as battalions are concerned.

It will be seen that all known weapons were produced in this conflict; their effectiveness depended on the completeness with which they could be used. There still seemed to be a feeling that malaria was a medical matter, even officers sometimes failed to realise that the simplest and most vital precautions were a responsibility of the troops and their leaders. Malaria control was already established in detail in every formation and unit of the army, but the means of its day-by-day implementation did not rest on a sufficiently firm disciplinary basis. Well organised units had their routines, but something more systematised was required. The senior medical officers of the 3rd Division, engaged in the difficult country north

and east of the goldfields, Saxby, A.D.M.S., Smibert, S.M.O. of 17th Brigade and Refshauge, S.M.O. of 15th Brigade, evolved the type of organisation needed to produce results.

During the period 1st May to 1st October units of the 15th Brigade were disposed in highly malarious country and carrying out patrol and sentry duties. Some of the posts occupied were in country which was malarious but not dangerously so, and certain elements were for variable periods in contact with the enemy. Owing to prevailing operational conditions native compounds were at times sited unduly close to bivouac areas. The degree of dispersal was characteristic of many operational areas in this country and it was obvious that only a unified method of malarial discipline could satisfy the requirements already clearly laid down, or be translated into successful prevention of malaria. It was of course understood that all anti-malarial routines should be followed in order to achieve results, but those depending on the personal performance of each individual soldier were most important. If adult vectors were numerous the faithful wearing of anti-malarial clothing, and use of an efficient repellent would minimise infection, and if covert infection occurred, as it almost certainly would, M.T. malaria could be cured and B.T. could be prevented from becoming manifest if an adequate suppressive such as atebrin was regularly taken in correct dosage.

As time went on units and formations whose members were kept on an insistent discipline were able to meet both the Japanese and the anopheline enemy without dangerous thinning of their ranks. An excellent example was set by the 15th Brigade whose commander, Brigadier Hammer, stood behind his unit commanders in enforcing their obligations to their men in malarious country. He proved that strict preventive measures could be put into effect while troops were in contact with the enemy. The 24th Battalion laid down an ordered routine which its commander, Lieut-Colonel G. F. Smith, promulgated as an Administrative Instruction on 8th November.

The rules laid down included the distribution of atebrin tablets to troops on parade (the men were actually seen to take the drug); inspection of their clothing, particularly that of guards and sentries was carried out, not by an N.C.O. but a platoon commander, who reported to his company commander. All company commanders and an officer from brigade headquarters were present at the parade. Nets were also inspected by platoon commanders, huts were sprayed and nets properly disposed. Difficulties of dispersal were met by the use of signals: early in December 128 miles of cable were required to complete the linkage of the battalion and ensured that all orders were obeyed. It was clearly stated that this daily routine was an officer's responsibility.

As will be seen, even these simple but stringent rules were not sufficient to prevent entirely the incidence of malaria, but the results obtained proved that the proper carrying out of the prescribed methods of malaria control depended on the unit officers and on the integrity of every man in the unit.

WORK OF SURGICAL TEAMS IN LATER PERIOD

The experiences of the surgical teams for the period of three months from 14th June to 13th September were much the same as those recorded earlier. Teams detached from the 2/1st Mobile Operating Unit were sent forward mostly on foot and worked at Missim, Meares' Creek, Kelly's, Uliap Creek, Bobdubi and Erskine. Major Row in a report on this work recorded that at Meares' Creek twenty-six operations were performed up to 22nd July, and during the next month, up to 24th August, 123 at Kelly's. Surgical work then declined in amount till the fall of Salamaua on 11th September.

At first, work was only slight at Missim, but a rush occurred later in July when sixteen casualties arrived almost simultaneously: two theatres were opened to deal with them. Operations performed here over the whole period numbered 245. Practically all urgent cases had received attention within twelve hours after wounding. Wounds of the extremities and long bones were relatively common: there were seventy-five of the upper extremity, including fifteen compound fractures of the humerus and six of the forearm, and twenty-four of the hands. Compound fractures of the femur occurred in eleven cases, and of the lower leg in fourteen out of seventy-five injuries of the lower extremity. Nine abdominal wounds were seen; of seven involving the peritoneal cavity only one was followed by recovery. Very few head wounds were seen: most were fatal. Steel helmets were not usually worn. Three cases of gas gangrene occurred, but the amount and degree of wound infection seen was much less than at Soputa. Fourteen chest wounds were treated; in eleven of these haemothorax developed; this was treated by intermittent aspiration: two became infected. "Sucking" wounds, five in number, had been closed successfully by the medical officer or his orderly. During the 2/7th Battalion attack on the Pimple, Sergeant W. Russell successfully stitched a sucking chest wound by the light of a cigarette within twenty yards of an enemy post.

Blowflies were most troublesome and persistent. Maggots did no apparent harm except to the patient's morale. Chemical means of control such as 1 per cent chloroform solution or boric acid were not tried at the time. Other teams which worked at Mango, Buigap, Tambu Bay, and North Tambu, operated on a total of 181 patients, mostly at Tambu Bay A.D.S.; of these eighteen were American troops. Stening reported that eleven compound fractures of the femur were treated, ten of the lower leg, fourteen of the hand, fourteen of the feet, six of the humerus and ten of the forearm. Local gas gangrene occurred in one thigh wound, and one wound of the buttock, but wide excision gave good results. Three out of four men with compound fractures of the skull recovered. Thomas splints were found most satisfactory by the teams for fractures of the femur.

A special report on resuscitation was compiled by Captain H. R. Macourt from the 15th Field Ambulance. In this he emphasised the importance of beginning the treatment of primary shock well forward, by relieving pain by posture, splinting and drugs. Most casualties needed

some measures of resuscitation, even if only of a minor kind such as hot sweet drinks. Greater degrees of shock were treated in the R.A.P. with blood serum usually one litre, sometimes given as rapidly as 500 c.cms. in half an hour. Men with injuries known to produce severe shock such as compound fractures of the femur, were treated early and thoroughly. A few rigors were observed early in the campaign, but greater care with sterilisation of the apparatus practically abolished these. When they did occur during a transfusion the procedure was not stopped, but reduced to the lowest practicable rate. The training of orderlies in resuscitation work was found to be essential.

Other reports gave similar accounts of the work done. In evaluating this it should be remembered that even reaching these posts was physically difficult, and work was often done there under conditions of great discomfort, depending to some extent on the weather.

ORGANISATION OF A "JUNGLE" FIELD AMBULANCE

The concept of "jungle warfare" really depends on considerations of transport. Refshauge outlined the principles established by the experiences of the field ambulances and their sub-divisions during the Wau-Mubo-Salamaua campaign, for the period January-September 1943. He pointed out that in jungle warfare the whole or part of the line of communication involved was impassable to wheeled transport; supplies and ammunition could come forward only by carriage e.g. by native porters, or by being dropped from the air either directly (free dropping), or by parachute; casualties could be transported back only by carrier teams. The field ambulance still retained its usual functions of remaining mobile, collecting and transmitting casualties. But in a country such as that which lay between the goldfields, with a few organised roads, and the coast, the time of transport of a wounded man might be long enough to be prejudicial to his recovery. Hence, in certain circumstances, there must be multiple posts, and it was then essential to bring a surgical team as far forward as possible, and therefore to train staff who could cope with technical responsibilities. Thus to the customary functions of a field ambulance was added surgical treatment carried out not only in the M.D.S. formed by the headquarters and the A.D.Ss. formed by the two companies, but if necessary, in each of three sections formed by sub-dividing each bearer company. Two of these sections would then have a medical officer in charge and the third a bearer officer. A unit of twenty-five beds was found to be the most practical. Further sub-division was sometimes necessary to provide staging posts. Extra nursing orderlies were drawn from the orderlies of the headquarters establishment to assist in working the 150 to 250 beds often required in an M.D.S.

In order to maintain efficiency it was found desirable to have equipment of sections interchangeable. Certain additional equipment was also needed, for example, it was necessary to produce palatable food for patients in an A.D.S., and this could not be properly done without extra cooking equipment. "Improvisation" as Refshauge remarked "is a good word and

is useful if used properly." The equipment, like the unit, had to be mobile, and this was best ensured by packing it in boxes containing not over 35 to 40 pounds. Each section needed about fourteen days' supply of medical stores and comforts; any emergency requirement could be obtained by carrier. Light tabletops of the venetian blind pattern were found useful; these could be carried by native boys.

Light water-proof tarpaulins when available provided good cover for wards, a theatre and accommodation for staff. Sisalkraft could also be used, but the time needed for erection was greater. The siting of these A.D.Ss. was important, chiefly in relation to the R.A.P., so that no time would be lost in giving surgical service. It was desirable for an A.D.S. to be on a line of communication, to avoid being off the main track for supplies or evacuation of troops.

Beds of some kind were necessary in all forward posts in which patients were kept overnight; the problem of weight was met by making and carrying bed-sails of canvas which was found much better than the conventional blanket. The following constructional points are worth noting as the product of experience in these jungle areas. It was important to give unobstructed passage to stretchers through the surgical wards; the uprights therefore should be placed off-centre. Operating theatres needed two tables, round which there should be ample room for movement. The resuscitation ward was, as on other fronts, next to the theatre: it could with advantage be part of the operating theatre.

Collection of casualties. Certain requirements were essential in this campaign. It was found convenient to have native bearers allotted to unit aid posts so that casualties could be carried back promptly to the A.D.S. The cooperation of the brigade staff captain was invaluable in these arrangements, which usually allowed the bearers to make several trips a day, provided that the A.D.S. was close enough to the R.A.P.

Treatment of casualties. The ambulance could of course not control the time-lag between wounding and surgical treatment, but time could be saved by having a surgical A.D.S. as near the R.A.P. as was safely possible. Prompt resuscitation was also essential, for the treatment of shock and haemorrhage was a prime function of the ambulance staff. Each section was capable of running a resuscitation centre on accepted lines.

Forward Surgical Posts. As in the Alamein campaign the blood pressure was found to be the most reliable guide to the degree of shock present. At these posts the medical officers and nursing orderlies were required to be competent to take and give blood or other infusion fluids, to perform gross typing of blood and to sterilise the apparatus. Record was kept of blood types of patients and also of personnel in neighbouring areas. Communication between unit and ambulance posts was highly desirable so that the surgical staff could be warned in advance of requirements, such as blood.

Nursing orderlies were trained in the after-care of patients and post-operative nursing was well supervised. This training extended also to orderlies attending patients suffering from endemic disease.

Evacuation of Casualties. Two different policies determined the transport of sick and wounded. Under certain conditions the ideal was to send all casualties out of the brigade area; on the other hand conditions might dictate the holding of as many sick as possible in this area. As a rough guide those likely to be fit for active work in fourteen days were held. Of course the first condition often could not be fulfilled, and these apparently conflicting policies were reconciled as far as possible by the judgment of the A.D.M.S. and S.M.O.

Where rapid onward movement was desirable walking patients were sent on with all possible speed to the next post; these often could safely include men operated on the previous day. Stretcher cases were selected on a priority basis which was made out each evening to suit the changing conditions of transport.

Where patients were temporarily held, more beds were needed, and provision was necessary for unexpected admissions. It was found that holding patients expected to recover within two weeks enabled some 70 per cent sick to be returned to the lines. Brigade rest areas were most helpful. Slightly wounded could be held in the forward areas; these usually approximated to 5 per cent of all wounded.

Supplies. The maintenance indent system was not a success, owing to the continual increase caused by the ever-lengthening string of staging posts. Another problem was the provision of containers: boxes and cases could not be sent back, and there was a continual demand for them. Bondwood boxes were regarded as "invaluable" by the A.D.M.S. They were light, water-proof, marked with the Red Cross emblems, and back-loading was possible without much loss. Specially designed boxes were used for dropping from Wirraway adapted trainers. Later, when forward supplies were maintained by air-dropping, indents were divided into a surgical indent for fifty patients and a medical indent enough for two weeks' supplies; they could be sent forward as required.

Much experience had been gained, and lessons learnt from these skilfully fought actions, and the individual and collective work of the medical services had been invaluable to the medical corps and the forces involved. Now we must turn our attention to the actions on Lae and Nadzab which overlapped the conclusion of the Salamaua operations, and formed an important prelude to bold actions on the Huon Peninsula.

CHAPTER 9

HUON PENINSULA CAMPAIGNS

IT has been shown earlier that the axis of advance from Wau did not point only at Salamaua. Far-sighted strategy recognised the importance of dispossessing the Japanese of islands to the north of New Guinea, and of recapturing New Britain. This implied mastery of the sea approaches and, still considering the future campaigns step by step, demanded the thrusting of the Japanese from their strongholds on the north coast of New Guinea. Hollandia, Wewak, Aitape and Madang were all considerable distances apart, but constituted firm bases from which attacks might be launched, counter-blows repelled, flanking movements carried out and control ensured by sea, air and land. On the Huon Peninsula were strongholds too, the capture of which was essential, so that from these bases attacks and by-passing manoeuvres could be safely made. With these ambitious plans viewed thus in reverse it was evident that the Allied forces in pressing on to the coast from the goldfields would not merely aim at Salamaua as an objective, but at Lae and its neighbouring airfields. Hence the latter half of 1943 had scarcely begun, when Lieut-General Herring was able to indicate to Major-Generals Wootten and Vasey, commanding the 9th and 7th Divisions, the Commander-in-Chief's plans for a major offensive. The first and most clearly defined objective was the taking of airfields which would give dominance over the Lae-Markham Valley area, and permit quick and decisive movement against the Japanese on the Huon Peninsula.

To the medical services these campaigns presented new problems, for the large-scale operations involved an air movement on Nadzab, with its great strategic aerial possibilities, and a sea-land strike to the east of Lae. Such operations would require considerable development of sea and air movement of the sick and wounded, and land evacuation would be further complicated by the deployment of casualties over country frequently intersected by rivers, some of which presented formidable obstacles.

During the Wau-Salamaua campaign advanced medical posts often had to be built and equipped on the mountain ridges at short notice, but now medical parties would need to treat casualties at a still earlier period of action, and to evacuate them under even greater difficulties. Transport would be developed in all its varieties, and fresh bases would be exploited as the lines of communication lengthened. Even greater difficulty might be experienced in the evacuation of casualties during amphibious landings.

Farther back approach areas were needed, such as air bases set up at Milne Bay, Goodenough Island and Dobodura, and plans were made to develop other air bases on islands at the south-eastern tip of New Guinea. In addition the exploitation of suitable posts on the seaboard, such as Milne Bay, Oro Bay and Buna provided linkage of other evacuation routes by sea.

TAKING OF LAE

The immediate plans were conditioned largely by the nature of the terrain over which land forces would advance to take Lae, and later drive the Japanese farther north. The Markham River, losing the pristine force of its headwaters in the Finisterre Range, spread out widely in the Markham Valley, making approach to Lae difficult from the south. The Ramu, rising in the same way in the Kratke Range, flowed through a narrower alluvial valley towards the north-west and fanned out to the coast not far from the Sepik River. The valley areas, particularly the extensive Markham, were suitable for airfields, and the best area for an air base against Lae was Nadzab. Therefore the 7th Division, experienced in actions in jungle and mountain country, and since then specially trained in air movements, was chosen to fill the role of the first Australian air-borne division.

The 9th Division was assigned amphibious landings on beaches to the east of Lae. During August detailed planning began at New Guinea Force headquarters under the direction of General Blamey and his Chief of Staff, Major-General F. H. Berryman; Lieut-General Herring thereafter commanded I Australian Corps. This force collaborated with the United States Navy and the Fifth United States Army Air Force in constructing a combined plan.

For the purposes of description, and particularly of setting out the medical tactics involved in the Lae operations, it is simplest to divide the action into two parts; the landings east of Lae on the shore of the Huon Gulf, with the subsequent assaults of the force defending Lae, and the air-borne attacks on Nadzab.

The 9th Division underwent a course of jungle training on the Atherton Tableland, following its return from the Middle East, and profited by the experience of other formations which had been engaged in jungle operations. The attached medical field units had some opportunity to acquire individual practice on the tableland, and at Cairns special exercises were held in combined operations. These rehearsals of sea landings were rather limited in scope by the demands of other Allied Pacific fronts, which restricted the numbers of small craft available. There were, in fact, never enough craft at any given time to exercise the field ambulance with its brigade. Unfortunately the 2/3rd C.C.S. was unable to participate in jungle training of its members as the unit was fully engaged in looking after the sick. For the same reason the C.C.S. could not join in rehearsals of combined operations with small craft held at Cairns.

Even at this stage it was realised that there were difficulties in organising medical arrangements of Allied forces by reason of the different methods adopted by the Australian and American medical services, and their various degrees of experience in action. For example, the joint evacuation plan included the use of medical units of two Allied forces in the forward arrangements for evacuation of sick and wounded. Even in methods of handling and recording casualties there were wide differences which in the opinion of Colonel B. S. Hanson, A.D.M.S. of the 9th Division, were likely to lead to confusion.

MEDICAL PLANNING

The medical plan aimed at providing for prompt collection of casualties and the allocation of a detachment of a field ambulance in support of each battalion. This called for the early establishment of a medical unit within the beachhead, and the establishing of an advance station where necessary surgery could be performed early. Transport of wounded would be difficult unless distances were short, for native bearers were not available, and bearers of the field ambulances were relatively few. The arrangement was therefore designed to provide a series of dressing stations, which would give surgical aid, and, avoiding staging posts as far as possible, would move forward as the military situation permitted. It was desirable that such forward stations would be able to move from the traffic of the beachhead as soon as possible, and have access to both the main coastal track and a subsidiary track leading to a beach where sea evacuation could be provided.

For purposes of organisation some of the ambulance drivers were used as bearers, and each ambulance company was divided into two parts, each of which could provide an A.D.S. commanded by a medical officer, and consisting of one or two officers and thirty-five men. Each section supported a battalion, thus leaving a reserve at the disposal of the ambulance commander. Care was taken to provide men in each section who could carry out the basic functions of members of a field ambulance, who might be called upon for nursing, bearing, cooking, driving and clerking. The ambulance members each carried a load of about 20 pounds, and each of the four (out of seven) jeeps allotted to the forward dressing stations carried 1,000 to 1,200 pounds of stores. Extra stores were to be brought in by ships and small craft, with the proviso that the weight of no single item should exceed the lifting power of two men. Jeeps were equipped with frames to permit carriage of four stretchers: one sitting patient could also be carried. The American medical corps would provide a medical company which consisted of clearing, collecting and portable surgical sections, one of each, with two "mission aid stations" which were somewhat expanded aid posts. The function of this company was the collection and treatment of wounded on the beach, giving assistance to Australian surgical services if required, and evacuation of the Australian C.C.S. and beach M.D.S. if within 400 yards. This unit also had the responsibility of all evacuation of casualties from the shore to the ships. The A.D.M.S. of 9th Division doubted if this was practicable, and these doubts were amply justified. Hanson pointed out that the proposed use of an American medical unit "at the very apex of the Australian collecting system" was a risky experiment, especially as the unit would be lacking in relevant experience.

Brigadier Furnell also experienced difficulties in ensuring adequate liaison between the Allied medical services, although conferences of the officers concerned, who included Admiral D. E. Barbey as S.M.O., United States Navy, and Brigadier R. N. L. Hopkins, Australian liaison officer, were fully briefed before meetings were held at Milne Bay. Though drastic revisions of the plans were made at these conferences, they were not duly

notified to the officers concerned, and in view of the risk of break-downs Herring arranged for the D.D.M.S. to fly to Buna for special meetings with Barbey. Final arrangements were thus made, but there were obvious drawbacks in such last minute two-man conferences.

THE 9TH DIVISION'S LANDING OPERATIONS

The successful reduction of the incidence of malaria in Milne Bay made it possible to exploit this valuable harbour and to use the area for staging troops *en route* for other operations. The 9th Australian Division was assigned the leading role in the landings made by the amphibious force. Air support had been made effective by the provision of an airfield at Tsili Tsili in the Watut Valley, and landing facilities at Bena Bena. This gave fighter protection to the medium bombers operating from Dobodura. Allied troops had also provided protection for these vital airfields, and the country south of the Markham River was vigorously patrolled. Consideration of the plan during July led to an increase in the covering forces for the amphibious movement, and exercises carried out at Normanby Island led to some changes in the detailed plan. The final arrangements were based on simultaneous landings on two beaches; the chief of these was called Red Beach, and the subsidiary Yellow Beach. The plan provided for a preliminary bombardment by destroyers, followed by the carrying out of the operation by three separate groups of Australian troops.

Early in the morning of 4th September a convoy brought the first landing group in, after a bombardment of six minutes on the foreshores of the Red and Yellow Beaches. Landings were made by the 20th and 26th Brigades at Red Beach, and the 2/13th Battalion landed at Yellow Beach. Medical cover was provided for the assault brigade by the light section of the 2/3rd C.C.S., the medical company of the American shore battalion and the 2/8th Australian Field Ambulance with a surgical team attached. This surgical team from the 2/11th A.G.H. consisted of Major G. Newman Morris, Captain T. N. Bolger, and three orderlies.

The transport of medical units was not quite according to plan, as the landing craft used differed in type and size from those used in training on the mainland. The A.D.M.S. was not able to provide a complete medical and surgical service for the 2/13th Battalion; though this unit landed early it went ashore three miles from Red Beach, and was too isolated to permit further disposal of the medical resources. However a standard A.D.S. provided emergency service, and arrangements were made to return casualties to Red Beach in returning supply craft.

No real forecast of casualties was possible; if the landings were opposed there might be many casualties within a short time, with a later secondary wave as troops pressed on. It was not until the fifth wave of the first landing reached the beach that some thirty-four casualties occurred from a bombing raid. Just at this time the medical units were beginning a reconnaissance in order to establish collecting and clearing stations, and this important step was delayed. Parties of the American medical forces on the beach treated the men in an improvised shelter.

As there were no further casualties at this stage, arrangements could be made successfully for the setting up of an Australian medical area some 500 yards from the beach. Five hours after the beginning of operations, the 2/8th Ambulance had an M.D.S. ready to receive patients, though difficulty was experienced in bringing up enough supplies to the area, particularly in dragging wheeled vehicles off the beach. The same difficulty hindered the American medical company, and stores had to be carried by hand, thus delaying the siting of the unit. As expected, some confusion occurred in the early stages of the landing owing to lack of coordination between the evacuation orders laid down beforehand in the 9th Division Medical Operation Order and the orders issued after landing by the American shore battalion commander. This interfered with orderly treatment of casualties to some extent, and failure to keep records at this stage afterwards caused considerable trouble.

Later on the first day the 26th Brigade arrived, with an A.D.S. of the 2/11th Field Ambulance accompanying each battalion. The headquarters of the ambulance awaited further movement of the brigade, while some of the men of the companies helped the other medical units.

During the night of the 4th-5th some items of medical equipment were lost when a convoy was attacked: two L.S.T. were damaged and some casualties were sustained. Other medical parties arrived without harm, the heavy section of the 2/3rd C.C.S., some men of the 2/8th and 2/11th Field Ambulances and the 2/3rd Malaria Control Unit. The stores of the C.C.S. were ready loaded on ten-wheel trucks, and as soon as day came these were driven past where the light section stores were still immobilised, to the medical area. Pre-loading on trucks also had this advantage, that should hand carriage be necessary, it was more simply done with goods packed in groups and not dispersed. On the following night the arrival of the 2/3rd Field Ambulance with the 24th Brigade completed the requirements of the medical services attached to the 9th Division.

During this first stage of landing and assembly, the 2/3rd C.C.S., commanded by Lieut-Colonel J. E. Gillespie, settled near the Buso River and began to expand. Damage of the neighbouring American unit by bombing threw the task of caring for their patients on the Australian C.C.S.

On the 6th, when the stage of exploitation began, there was a considerable call for transfusions, and as whole blood and wet serum were insufficient in amount, American dried plasma was used with advantage. The 2/3rd Field Ambulance, under Lieut-Colonel A. W. Robertson, after a midnight landing on Red Beach, moved near a village and then on to the C.C.S. area, and sent light sections to the battalions. The 2/8th Field Ambulance, commanded by Lieut-Colonel L. M. Outridge, landed near the Buso River, and after moving into good scrub cover, admitted casualties from bombing raids and started work with their surgical team. Small sections were used to support the battalions. Lieut-Colonel W. W. Lempriere set up the 2/11th Field Ambulance in the medical area about one mile from the beach, with its headquarters near the M.D.S. Small sections of the bearer companies of this unit were kept attached to the battalions

pending their advance. The problems of supply and evacuation by sea and air were more difficult than the unit had found in the Western Desert, and cooperation with the Allied units intensified them. Further groups of the ambulance personnel landed with the 2/23rd, 2/24th and 2/48th Battalions and crossing the Buso River advanced towards the west. A jeephead was set up at Aluki, where divisional headquarters was later established.

By the 6th, the 26th Brigade was advancing north along the Burep River, and the 24th Brigade along the coast, where the Busu River was a serious obstacle. Communications were difficult and the medical detachments had great trouble in getting transport forward. Medical equipment and stores had to be carried by the men together with five days' rations and personal gear. Hanson found it impossible to keep accurately informed about forward conditions, and had to rely on the initiative of his medical officers. Fortunately their training had inculcated in them the importance of being self-reliant. The administrative troubles would have been intensified had there been many casualties.

This early period of consolidating the advantages gained at the landing was fraught with many trials. The headquarters of the 2/11th Ambulance moved to Apo over a difficult wet forest trail, and on the 7th, attempted on inaccurate information to set up an M.D.S. on a site wrongly believed to have access from the beach. The site, Singaua, was found impracticable, and was occasionally shelled, so that the unit moved on foot to the Burep River, and attempted to carry stores back to Red Beach and ship them to Burep River by water-craft. Gradually the 2/3rd and 2/11th Ambulances got their M.D.Ss. working, and a more or less regular run to and from Red Beach was organised. Transfer of wounded men to the 2/3rd C.C.S. needed great energy and determination, as the patients were carried by hand for over three hours over a rough corduroy track. The Japanese attacked Red Beach on the 6th and casualties from bombs occurred among the staff of the American medical post. The patients were transferred to the 2/8th M.D.S.: one hundred were divided between this unit and the 2/3rd C.C.S. On the next day, the A.D.M.S. instructed the American medical company to close, and the 2/8th Ambulance, using its vehicles, took over the collection of the patients centred in small craft on the beach, and arranged their evacuation to ships. It was found much more satisfactory to leave these functions to one authority, not to two whose training and method were along different lines.

THE 7TH DIVISION'S AIR-BORNE OPERATION

The 7th Division had been training in Moresby for an air-borne operation whose purpose was to assemble a land force west of Lae and north of the obstacle of the Markham River. This force formed the other half of the pincers, which with the 9th Division, was to seize Lae and establish coastal bases from which further actions would drive out the Japanese from the north-eastern coast of New Guinea.

The preparatory stages of this operation did not call for any but routine medical planning, which provided for medical cover of the 7th Division

based on the Bulolo Valley. Safety of supply lines and transport aircraft were ensured by the airstrip facilities already provided at Bena Bena and Tsili Tsili. The air-borne operation was planned to begin on 5th September, known as Z-day in order to avoid confusion with the D-day of the sea-borne invasion.

The first phase, the capture of Nadzab by paratroops, was successfully carried out under cover of air bombardment and smoke screens. The 503rd United States Parachute Infantry Regiment landed unopposed, with a paratroop detachment of the 2/4th Australian Field Regiment in support. Part of the Australian field regiment parachuted guns into Nadzab. Shortly after this the 2/2nd Pioneer Battalion and the 2/6th Field Company arrived as reinforcements. These two units had been flown to Tsili Tsili some days earlier, and on 2nd September proceeded overland to the southern side of the Markham River. On the advance from Tsili Tsili to Nadzab a detachment from the 9th Field Ambulance accompanied them for the first two days, and another party of one officer and eight orderlies from the 2/5th Field Ambulance were with them throughout on the march to Nadzab. The river crossing was soon accomplished by folding boats secretly brought up by night. The paratroop casualties were dealt with by medical officers attached to their own regiment, and those occurring in the A.I.F. were treated by the A.A.M.C. party.

The air-drop began at 10.35 a.m. on the 5th, and by evening on the next day a rough landing strip was prepared to a stage sufficiently advanced to allow some troop carriers to land with engineers and their equipment, and anti-aircraft guns. Troops were now coming through to Tsili Tsili from Moresby, and the divisional headquarters was able to move on to Nadzab on the 7th.

The first troops of the 7th Division to arrive by aircraft at Nadzab were those of the 25th Brigade Group, which, under command of Brigadier K. W. Eather, began the task awaiting the division, that of sharing with the 9th Division the attack on Lae. The first step towards this end was to prevent the enemy from reinforcing Lae overland.

The brigade began to advance along the Markham Valley road on the 8th. At this time only the 2/4th Field Ambulance was available for medical service to the attackers on Lae from the west. The headquarters of this ambulance arrived by air at Nadzab on the 7th, and on the following day set up an A.D.S. at the airstrip.

Captain H. J. Edelman and eight O.Rs. from the 2/5th Australian Field Ambulance were attached to the 503rd United States Regiment's collecting post. There were fifty-five jump casualties among the paratroops admitted on the 7th. Next day Lieut-Colonel Hobson arrived at Nadzab with some members of the 2/4th Field Ambulance and Captains W. P. Ryan and C. A. C. Leggett as the surgical team. The M.D.S. of this field ambulance was set up and Edelman's section established a plane loading post on the old Nadzab strip. Details of medical organisation were coordinated with the general plan, which was successfully carried out.

Labour commitments in this operation were considerable and varied. Shelters had to be erected for casualties, and domestic help was needed for medical units when the numbers held exceeded their capacity. Arrangements were made for the evacuation of casualties from less accessible places, and, though jeeps were relied upon where tracks were practicable, it was not possible to send wounded by this route. As a matter of fact the numbers of patients handled could not be kept down to the standards accepted for field ambulances. As in other campaigns, and those involving much less complicated movements than the aerial transport of a division, the medical resources needed reinforcements in times of stress. This could be given by a corps field ambulance, if such were available, or a C.C.S. in support of the divisional medical services. As in previous operations in tropical zones, the sickness rate exceeded the number of casualties due to battle injuries. The inroads of dysenteric diseases, typhus, and in particular malaria were worrying, and affected fighting strengths. In the early stages of the advance to Nadzab casualties were evacuated to Tsili Tsili, but after the paratroop landing they were sent forward to Nadzab.

THE DIVISIONS ADVANCE

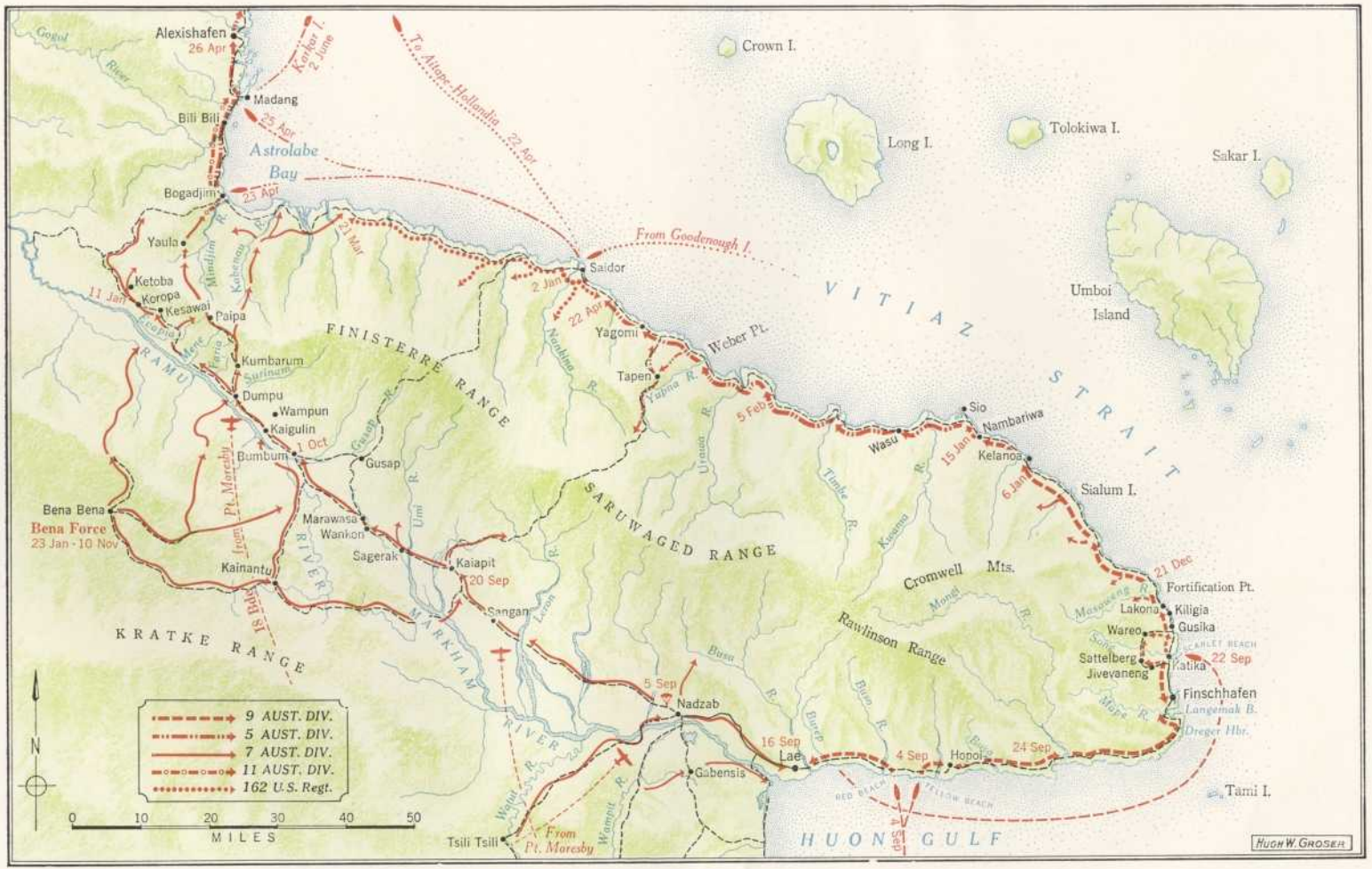
On the 8th, the leading battalions of the 24th and 26th Brigades of the 9th Division had reached the bank of the Busu River. The 25th Brigade of the 7th Division was ready for the advance from Nadzab, in spite of a tragic accident when a Liberator bomber had crashed into a company of the 2/33rd Battalion at Ward's drome, Moresby, while the men were waiting to emplane.

By the following day the two divisions were carrying out the second phase of their operation, the advance on Lae.

9th Division. The 26th Brigade, after the difficulties of the landings, was now faced with the crossing of the Busu River, whose broad channel ran swiftly shoulder high. Both the 24th and 26th Brigades found Japanese on the other side of the river, but late on the 9th, the 2/28th Battalion forced a crossing near the coast. Many of the men were washed away and some were drowned, and two-thirds of their equipment was lost, but they secured the position and held it against enemy attack. The 2/32nd and 2/43rd Battalions succeeded in crossing by small craft and by a road from the Burep River made by engineers.

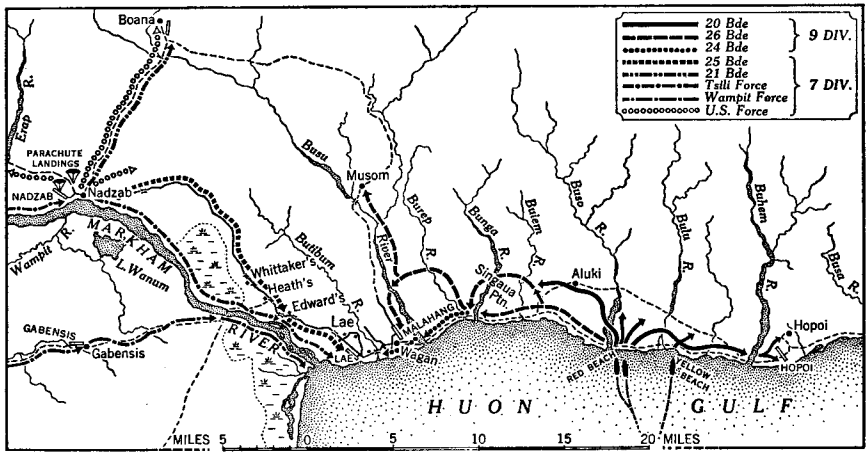
Casualties were sometimes collected under fire in the Busu area, and the forward battalions were subjected to shelling and bombing from the air. The 2/23rd and 2/24th Battalions advanced through dense rain forest from the Burep to the serious obstacle of the Busu River. The 2/23rd Battalion was shelled in this area, and the R.M.O. Captain J. F. Davies was killed.

Meanwhile the attached medical units had found the necessary movements made on previous days were difficult and exhausting; many of the carries undertaken on slippery jungle tracks involved severe strain on the stretcher bearers. At the beachhead also there was great activity, and problems arose with evacuation of sick and wounded. The American



Huon Peninsula

medical company which had originally been assigned the tasks of collecting patients and transferring them to outgoing ships, had been closed by the A.D.M.S. on the 7th, and Gillespie was appointed S.M.O. of the beachhead. On the night of 10th-11th the 4th Field Ambulance arrived at Red Beach with the 4th Brigade, which permitted the 20th and 24th Brigades to proceed together. This ambulance unit, commanded by Lieut-Colonel J. H. Body, relieved the 2/8th Field Ambulance and established an M.D.S. in the medical area on the beach. One A.D.S. relieved the post on Yellow Beach, and one at Singaua plantation. The 2/8th Ambulance was then used as a reserve with the 20th Brigade west of the Burep



Lae-Nadzab

River. Only a few casualties were handled here; these were taken by L.C.V. and L.C.M. from the mouth of the Burep and from Red Beach. Ambulance cars brought with the 4th Ambulance were used for transport of patients between the beach and the C.C.S., and usually negotiated the muddy tracks successfully, in fact better than jeeps. Sometimes, however, long and arduous hand carriage of patients was the only practicable method, especially at night.

The Red Beach area was surveyed by the 2/3rd Malaria Control Unit; no anophelines were found, and most of the infantrymen discarded their nets on account of the weight.

The effect of salt lack on energy was noted here, and the A.D.M.S. recommended at least three tablets daily for men working hard or marching through jungle. Along the coastal areas to the east of Lae the Japanese were still active, and more artillery was brought in to support the troops. On the 13th the men of the 9th Division pressed on along the coast and on the parallel track a mile inland, and by the next day the 26th Brigade had bridged the Busu and was holding a bridgehead. The Japanese, after resisting strongly, abandoned their positions during the night. On the

morning of the 15th the 2/24th Battalion captured a strong enemy post north of the Busu crossing and inflicted heavy losses, and the 2/23rd and 2/28th Battalions repeated these successes at Malahang anchorage and the sawmill area. The three brigades, the 20th, 24th and 26th continued to press on towards Lae with little opposition, and made contact with the 7th Division on the 16th.

During the period elapsing between the beach landings and the actual final advance on Lae the field ambulances of the 9th Division had many problems. Heavy rain, deep mud, difficult tracks and river crossings made the movement of sick and wounded a labour. In the second week of these operations there were many calls on hospital accommodation. The men of the 2/3rd Field Ambulance were often knee-deep in mud on the tracks, erection of tents was most difficult, and the theatre and resuscitation ward were two feet in mud, needing a corduroy base. When the Busu was crossed it was necessary to carry sick and wounded by hand over corduroy road to the Burep and then by jeep to the mouth of the river. Here the river was wide but shallow with a stony bed, and easily crossed by jeep. Two patients with compound fractured femur were carried across the Busu footbridge by hand. The personnel of the 2/8th M.D.S. had to act as stretcher bearers to the beach by night as the mud made the roads impassable for jeeps. Their work was made more difficult by an outbreak of bacillary dysentery thought to be due to infected water.

For several days before the Japanese resistance faded, there were numbers of patients requiring resuscitation, and a satisfactory method of cleansing Soluvac bottles was not easy to devise. The only water available was from the muddy Burep River, but, although some deposit could not be avoided, boiling the bottles and running through dextrose solution seemed to be satisfactory, as no reactions occurred from this cause. Major D. G. Duffy compiled notes on resuscitation at the 2/3rd C.C.S. during the combined operations. There was considerable call for blood, and supplies of whole blood and wet serum ran out: American reconstituted dry plasma was again useful. Casualties from bombing attacks, particularly in the first assaults by high explosives, frequently needed up to four litres of whole blood: lesser quantities of blood or serum did not lower morbidity or mortality rates. In later stages blood was sent from Morobe, and travelled well packed in ice; blood left in the melted ice kept for two or three days. Blood was taken from troops working on roads with the technical assistance of orderlies trained in blood banks in the Middle East. There were drawbacks to the use of operational troops as donors: stored blood would have been helpful in both light and heavy sections of the casualty clearing station in the initial landings.

The 2/8th Ambulance found some of the hand carries very long from the remoteness of the places where patients were found. Movement of patients with severe injuries was most difficult on the narrow beach strips. The M.D.S. of this unit moved to the Busu on foot, and there handed over to the 4th Field Ambulance. The position was eased by the use of five A.D.S. sections as staging posts for casualties from the Busu area.

7th Division. Meanwhile two additional airstrips were started at Nadzab, and on the 10th this work of airfield construction was taken over by American aviation engineer battalions. The 25th Brigade was advancing down the narrowing Markham Valley towards Lae. The engineers worked hard to provide roads between Nadzab and Lae for the moving troops, their guns and their supplies, building bridges and culverts, draining and clearing the tracks. Infantry and artillery cooperated closely as the pace increased. The 2/4th Field Ambulance was able to cope with the medical cover for the 7th Division forces, and manned posts along the main road to Lae.

On the 12th, the 2/25th Battalion drove farther on and expelled the Japanese from positions in Whittaker's plantation. Holding the road at Whittaker's bridge the battalion placed two of its companies in strong positions on high ground overlooking Heath's plantation, which the patrols of Kanga Force had so carefully explored months earlier. Repelling attacks on the night of the 13th, the battalion crossed the bridge next morning and captured the destroyed Heath's plantation. During the final attack on these positions the A.D.S. moved up well forward with a surgical team near Heath's plantation, but some difficulties were experienced by the regimental stretcher bearers in bringing casualties from the 25th Brigade to the M.D.S. Delays as long as eighteen hours occurred in places owing to difficulties in picking up the wounded. The Japanese resisted strongly at first on the 14th, at Edwards' plantation, but air and land attack soon broke down their stand. Next day there remained only the question of how much resistance was to be expected from the remnants of the Japanese forces who were still living and who had not escaped, as did the majority, from the stricken areas. Many Japanese escaped from the operations at Lae, but there was reason to believe that weakened by starvation, illness and exhaustion very few were successful in reaching the north coast.

FINAL ENTRY INTO LAE

Battalions of the 9th Division crossed the Busu River on the 15th accompanied by their light ambulance sections and occupied the Malahang airfield. The 24th and 26th Brigades were ordered to press on early the next morning to the Butibum River, but an air attack on the local strongholds was no longer necessary. The 7th Division found that all resistance had disappeared from the outskirts of Lae, and all that hindered their entry to the town was the fire of the 9th Division's 25-pounders, which caused temporary cessation of movement for some two hours. Early on the afternoon of the 16th the 7th Division entered Lae, and the 9th Division held the commanding area of Mount Lunamen to the sea. The two assaulting divisions soon made complete contact in the ruined town and this phase of the operations was over.[1]

The occupation of Lae drastically altered the medical position. No longer was the main problem one of overcoming the natural obstacles of

[1] Australian casualties in the advance to Lae 4th-16th Sept: killed in action 16 officers, 198 other ranks; wounded in action 38 officers, 435 other ranks.

the terrain and the resistance of the enemy. Capture revealed the town as an insanitary place, ruined by bombing and defiled by dumps of rubbish and dead bodies. The question was now one of restoring a foul and shattered township to a place not only safe from sea, land and air, but safe for living.

FINSCHHAFEN

The responsibilities of the 25th Brigade at Lae ended with the formal capture of the town area, and the next day, 17th September, the men of the 7th Division returned to Nadzab and left Lae to the 9th Division, whose task was now to expel the Japanese from Huon Peninsula as the necessary step in gaining mastery of the Vitiaz Straits. There was no delay in planning, for on the 18th Herring gave the 9th Division the assignment of the capture of Finschhafen and Langemak Bay. These objectives offered a base for attack on Western New Britain and were to be attained by further sea landings. Red Beach, which had been the site of the medical centre during the action, was dwindling in importance, and men needing attention were easily looked after by the forward M.D.Ss. Within a week of the fall of Lae patients were being sent back by empty supply planes, and as Lae was cleared it became more and more the local base.

LANDINGS ON SCARLET BEACH

On the afternoon of 21st September, the 20th Brigade and associated troops began to embark from Red Beach and G Beach east of Lae. The area chosen for the landing of this continued operation was on a beach known for the purposes of the action as Scarlet Beach, near Katika, north of Finschhafen. As the landing ships made for this beach, the 22nd Battalion began to move overland from Hopoi on the Huon Gulf, converging towards the objective of the sea-borne force. Preparations for departure were hurried. The medical units had to gather their stores hastily. The 2/8th Field Ambulance assembled nine tons of equipment and stores from three areas, two tons in excess of the official allotment, though the unit thought twelve tons was needed. Medical stores were fairly adequate for the necessary reserves: stretchers were scanty and some were beginning to rot from heavy service in the humid climate, but engineers supplied sixty of durable steel mesh. Twenty American pyramidal tents were also supplied and found most useful. These tents were successfully adapted for operating theatres, two tents brigaded gave space for two tables.

On arrival at the beach early next morning the landing parties found that preliminary sea bombardment of Scarlet Beach, the selected area, had not prevented opposition by the Japanese. The first two waves of landing craft mistook Siki Cove, a small inlet to the south, for Scarlet Beach, and landed there. The light section of the 2/3rd C.C.S. had left Red Beach under Major W. R. Gayton and arrived at the landing beach at midnight on the night of 21st-22nd. This unit and the 2/8th Field Ambulance supplied the chief medical cover for the initial movement to Finschhafen. The 2/8th Ambulance undertook the medical care of the

20th Brigade and a section of the 2/11th Field Ambulance under Major R. Mackey accompanied the force for purposes of beach evacuation. A detachment of the 11th Malaria Control Unit was also sent. As opposition was expected, facilities were provided for holding patients for some fifteen days, and the 2/8th Ambulance had with it a surgical team comprising Morris and Bolger. The third wave to reach the landing area became assault troops, facing enemy opposition, and casualties occurred early from small arms fire; some men were wounded while on the landing craft, and others on the beach or in the water. Outridge, who was S.M.O. of the landing beach area, had difficulty in securing attention for some men, as they were wounded before a post could be established. Some members of the medical units were carried off again on the landing craft while they were still attending to wounded.

MEDICAL ARRANGEMENTS

The medical area was placed 250 yards inland from the beach, and for convenience of administration the M.D.S. of the ambulance and the light section of the C.C.S. were set up close together by direction of Colonel Hanson. Later Hanson questioned if this disposition was advisable, as adequate dispersal was difficult, and combatant installations soon collected round the medical area, making a good bombing target. It was soon found that fires attracted air raids, and in the effort to avoid smoke medical units had great trouble in feeding patients. A few members of the staff and patients were killed in the medical area, and there might easily have been more, for bombs fell nearly every day, and often several times a day, during the first fortnight.

At first the medical plan did not include any members of the American medical services, but later a detachment set up at the beachhead, and worked happily with the Australian centre, sharing their work and their risks. When the American forces developed an area in the region of Dreger and Schneider Harbours the detachment handed over its patients to the 2/8th Ambulance and reverted to American command.

Fifty-three casualties came through the 2/8th M.D.S. on the day of the landing; a large proportion of wounds were serious, and raised problems in resuscitation. There were no delays in clearing patients by Mackey's A.D.S., as most of the casualties occurred in the jungle fringing the narrow beach. Sixty wounded passed through this A.D.S.: some of these casualties were due to snipers who attacked the area between the advanced and main dressing stations. Surgical work was promptly begun at the M.D.S. as soon as it was set up, and twenty-six operations were performed on the day after the landing. Twenty-six patients were sent out by L.S.T. but, in accordance with instructions, no seriously ill were included.

Certain difficulties were experienced during the Scarlet Beach landing which could not be avoided because of the demands of tactical planning. Forthcoming operations in the South-West Pacific Area demanded the diversion of the main strength of the Allied Air Forces; this reduced the

amount of protection which would otherwise have been desirable for the establishment of the landing forces. Landing sea-craft were being assembled for use in assaults on New Britain, therefore only a much smaller number of such craft could be spared for the combined operation on Finschhafen.

On the 23rd the Australian force began to advance down the coast to Bumi River. By next day evacuation of sick and wounded was proceeding by sea through the 2/11th Ambulance section to Major K. J. J. Dorney's A.D.S. at Lae, and then on by sea or air to Moresby. The A.D.M.S. directed that all patients likely to be in the M.D.S. more than two days should be sent back if possible. There was considerable enemy air activity on the 25th, and the M.D.S. underwent daily air attacks, but the A.D.Ss. were well protected on land by the battalions. The force had now to consolidate its strength, and began to construct a jeep track connecting with the track along the coast to facilitate transport of casualties and supplies.

The 2/43rd Battalion relieved the 2/17th Battalion at Scarlet Beach on 30th September. The A.D.Ss. moved gradually south in support of the battalions, but the M.D.S. was too busy to move to a less congested and therefore less bombed area, especially as a number of severely injured men were under treatment. As the operational commitments of the force increased, the staff of the M.D.S. observed that the percentage of proven malaria among men with febrile symptoms was also increasing. It was suggested this might be related to the discarding of nets by men in operational areas. There was an outbreak of diarrhoea in the 2/24th Battalion; it was suspected to be dysentery but no sulphaguanidine was available in the area for treatment. On the whole, the health of the men had been satisfactory, but the numbers of sick were now increasing and were beginning to call for more accommodation.

MOVEMENT ON FINSCHHAFEN

The enemy was still showing strong resistance: the 2/15th Battalion advanced down the coast towards Finschhafen till the Bumi River was reached, and there found an active Japanese force at the coastal crossing. The Australians crossed the river higher up, and patrols found the enemy in growing strength at Sattelberg. The 20th Brigade now concentrated its forces after the arrival of the 2/43rd Battalion, and on 1st October with heavy air and artillery support, a severe action began and lasted all day while the 2/13th Battalion attacked strong positions at Kakakog. On the following morning the Japanese were found to have withdrawn, and later in the day Australian troops occupied Finschhafen, while contact was made with patrols of the 22nd Battalion. This battalion had come overland from Red Beach, and now united with the brigade south of Langemak Bay.

By the 8th an administrative change was made in corps command: the Headquarters of the I Australian Corps was relieved by the Headquarters of the II Australian Corps under command of Lieut-General Sir Leslie Morshead. Three days later the Headquarters of the 9th Division was established on the northern shore of Langemak Bay.

ESTABLISHMENT OF MEDICAL UNITS

The position was now firmer in the southern part of the peninsula, where supplies could be brought in by small craft. The C.C.S. had meanwhile left Red Beach in convoy on the 7th, its craft overloaded with its heavy equipment; after overshooting the correct landing beach and meeting some evidence of hostility, it had reached Scarlet Beach and thence was redirected to Kedam Beach. On arrival the C.C.S. was able to give immediate help to existing units by assigning twenty orderlies to work with the light section.

The sea ambulance detachment of the 10th Field Ambulance arrived at the same time, and under the command of a bearer officer greatly improved the conditions of transport returning to Lae. The site chosen for the 2/3rd C.C.S. was at Simbang on the shore of Langemak Bay. Some care was necessary in the selection of a site in view of the expected counter-attack by the Japanese; protection from the air was specially considered. Heldsbach had been marked as a future good medical site, but at this time was unsafe. Sattelberg, a previously proposed site, was also in the hands of the enemy. The opening of the C.C.S. could hardly have come at a more opportune time, with increasing casualties due to the enemy and to disease, and with urgent need of more holding space for patients. Malaria control was early under way; the 2/3rd Malaria Control Unit arrived at Finschhafen on 11th October. On the 14th the 2/3rd C.C.S. began to settle in to its new site at Simbang, tents were pitched and ward areas allotted. Some help was obtained from the 2/3rd Field Ambulance which supplied a medical officer and a detachment of O.Rs. and a few days later twenty natives were available for building huts. In spite of an early start the unit had difficulty in catching up with demands; patients poured in from the beginning, and were admitted to huts while the roofs were half complete.

JAPANESE COUNTER-ATTACKS

No sooner had full work begun in the C.C.S. than enemy activity flared up in a serious bid to recapture Finschhafen. The Japanese had withdrawn to the Sattelberg area and it was essential that this strong flanking position should be cleared. Sattelberg was a valuable stronghold, rising to an elevation of 3,400 feet and overlooking Finschhafen and Langemak Bay, and was linked with a steep high spur at Wareo. This was of almost equal elevation, and separated from the high ground north of Sattelberg only by the basin of the Song River. Thus the Wareo-Sattelberg area was of considerable military importance; the Japanese had concentrated a strong force there, and were reinforcing it by sea and land, no doubt with a view to counter-attack on Finschhafen.

Local air raids in the vicinity of the medical area had given warning of further attacks, and Intelligence information confirmed this. On the 17th a bombing raid on Finschhafen heralded an enemy attack from the sea, but the defenders were ready; enemy barges were sunk and all troops who landed were killed. A landward attack was still to come and later

on the same day this began. The Japanese attacked the headquarters of the 2/3rd Pioneer Battalion at Katika less than 3,000 yards west of Scarlet Beach. The battalion had to withdraw to a locality defended by the 2/28th Battalion in the Scarlet area. The divisional commander asked for the 26th Brigade to be sent forward.

MEDICAL UNITS UNDER ATTACK

On the next day the Japanese renewed the attack on Katika, where there was very heavy fighting. When direct approach to the beach was denied them they branched off to the north and to the south, and reached Siki Cove near Scarlet Beach. These moves threatened to be highly dangerous to the medical units. The light section of the C.C.S. and the M.D.S. of the 2/8th Ambulance were specially menaced. Already hampered by heavy rain some days previously, which had caused collapse of a ward and left water a foot deep in excavated areas, the light section was further required to admit more casualties than usual. This work was interrupted by bursts of automatic gun fire through the lines. The members of the unit armed themselves, and made a thin defensive line round the wards to protect the patients. In the early afternoon two mortar shells fell very close and evacuation of all patients was decided upon as the only wise course. All patients were accordingly carried by hand to the beach, where the staff of the C.C.S. loaded casualties on to barges. All equipment and personal gear were left behind, and the sick and wounded were taken by barge to the main body of the C.C.S. where they arrived just before dusk. This strained the resources of the C.C.S. greatly: there were then 285 patients held in hospital.

When these events began to occur the 2/8th M.D.S. was still in its original site at Katika, using the 2/11th A.D.S. as an evacuation centre. Light A.D.Ss. were in support of battalions; one had been sent on the 13th in support of the 2/13th Battalion for Simbang. On the 17th the 2/8th Ambulance, like the light section of the C.C.S., was attacked. Bombing stripped the ground on each side of the unit, but the medical area was hardly touched. No red cross was displayed where it could be seen from the air; one flag only hung at the entrance, visible from the ground.

As the 24th Brigade controlled Katika, the M.D.S. served this and the other brigade with their ancillary troops. On the following day the M.D.S. was attacked by enemy fire from rifles, machine-guns and mortars. Fighting was going on within 100 yards of the site on which active medical work was proceeding, and evacuation was imperative. Stretcher cases were carried to the southern end of the beach, and barges bringing material took back all patients to the 2/3rd C.C.S. at Simbang. The surgical team and the surgeons from the light section accompanied the patients and resumed their work on arrival at the C.C.S. Here they worked in conjunction for several weeks; fortunately there was not a great volume of surgical work. The remainder of the 2/8th M.D.S. and the light A.D.S. established a temporary dressing station with twenty beds on the beach

at the road to Sattelberg. All facilities for resuscitation were available at this post.

On the 19th an attempt was made to salvage material and equipment from the site of the M.D.S. on Scarlet Beach, but a good deal of looting had been going on, and much was lost. In the evacuation of patients from the medical area the detachment of the 2/11th Field Ambulance was of great assistance in collecting casualties at the beach point and placing them on the barges to the C.C.S. Help was also available from the 2/3rd Ambulance.

FURTHER ARRANGEMENTS

Certain other moves took place. The 26th Brigade Group embarked on L.C.T. and landed at Langemak Bay on the 19th, and the 2/11th Ambulance was relieved by the 7th Field Ambulance when the 42nd Battalion of the 5th Division relieved the 2/24th Battalion at Lae.

One change was made in the arrangements for medical evacuation: all battle casualties were to be sent to Buna by sea, but medical cases were to be retained as far as possible.

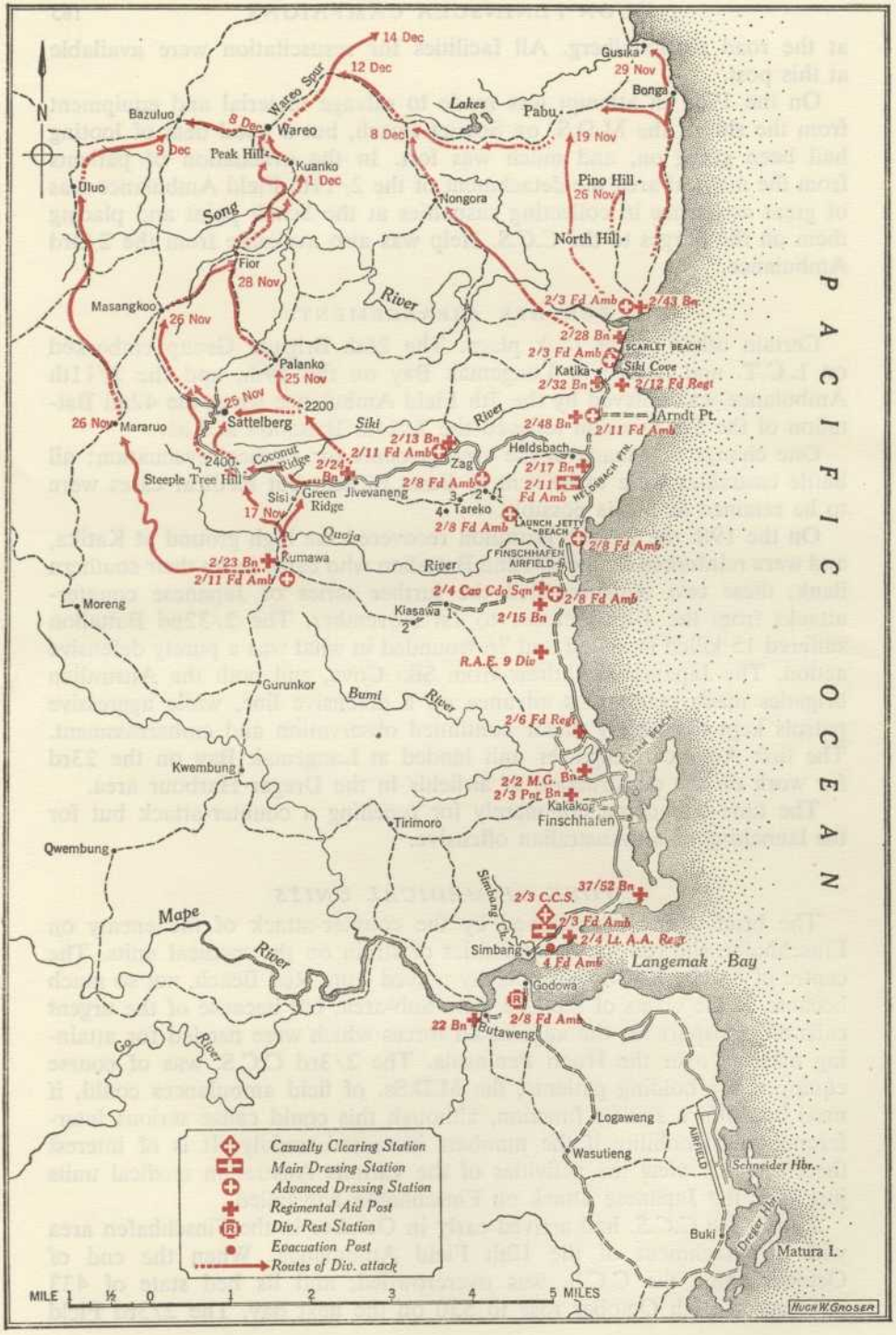
On the 19th the 2/28th Battalion recovered the high ground at Katika, and were reinforced by the 2/32nd Battalion who came in on their southern flank; these two units repelled the further series of Japanese counter-attacks from the 19th October to 1st November. The 2/32nd Battalion suffered 15 killed in action and 76 wounded in what was a purely defensive action. The Japanese withdrew from Siki Cove, and both the Australian brigades made continuous advance on a defensive line, while aggressive patrols kept the enemy under continued observation and embarrassment. The first American engineer unit landed at Langemak Bay on the 23rd for work on the construction of airfields in the Dreger Harbour area.

The time had come not merely for repelling a counter-attack but for the launching of an Australian offensive.

WORK OF MEDICAL UNITS

The brief actions occasioned by the counter-attack of the enemy on Finschhafen showed the potentialities of strain on the medical units. The centre of gravity had not completely moved from Red Beach, not so much because of the wants of the Lae Base Sub-area, but because of the urgent calls on transport for the augmented forces which were needed for attaining mastery over the Huon Peninsula. The 2/3rd C.C.S. was of course equipped for holding patients; the M.D.Ss. of field ambulances could, if need be, fulfil a similar function, although this could cause serious interference with mobility if the numbers increased unduly. It is of interest therefore to review the activities of the various Australian medical units just after the Japanese attack on Finschhafen had failed.

The 2/3rd C.C.S. had arrived early in October in the Finschhafen area with a detachment of the 10th Field Ambulance. When the end of October came the C.C.S. was overcrowded, and its bed state of 433 patients on 24th October rose to 530 on the next day. The 2/3rd Field



Medical dispositions, Finschhafen, 5th November

Ambulance afforded relief by taking fifty patients with malaria. It was also a great relief to the unit when on the 26th, night bombing ceased, at least temporarily, after having been continuous for weeks. The strain of night work was considerable, particularly when tent theatres had to be blacked out; convoys usually arrived about dusk. At Scarlet Beach the pyramidal tents were sunk about four feet to avoid bomb blast and splinters.

Preparation of food for troops on active fighting duty caused some problems, since open fires attracted enemy attention and smoke disturbed the patients for similar reasons. In the 2/3rd C.C.S. this was overcome by the construction of oil-water drip fires. Invalid foods were obtained with the help of Red Cross representatives. Shortage of some supplies caused occasional embarrassment; for example, supplies of fuel were insufficient to run the generator, and operations were performed using lamps run off batteries. Further assistance to the unit was given by the 2/8th Ambulance when at the end of the month this unit began to run a divisional rest camp, and took men convalescing after malaria.

The strain on the beds of the heavy section of the C.C.S. increased in the beginning of November; malaria was rising in frequency and gave more work in numbers of ways. Microscopic diagnosis with its exacting examination of slides was itself a considerable burden. The weather was very bad early in November, the heavy seasonal rains became torrential, and ruined the roads. A bridge was washed away on the road to the C.C.S., and patients actually had to wade in water up to their armpits at one time; others who arrived later swam the stream. The flooded condition of the roads caused again paradoxical difficulty in the carriage of water supplies. In the unit the strain of holding 530 patients was felt, and speaking generally the medical services found it hard to meet demands. Transport of patients was very troublesome at times. Patients arriving at Simbang Spit had to be carried three-quarters of a mile over the very bad road. On 12th November the usual malarial epidemic sequence was observed; simple increase of numbers of patients with malaria was now followed by an increase in average severity, so often a precursor of an outbreak of malignant tertian infection. Dengue fever, which was rife throughout the coastal area, was also increasing in amount.

The 2/3rd Field Ambulance had embarked at the mouth of the Burep River for Scarlet Beach on 18th October, and arrived there while the medical work was being done under disturbed and dangerous conditions caused by the Japanese attack. The unit detached Captain F. T. Rose and thirty-one O.Rs. to the 2/3rd C.C.S., where they helped with patients from the evacuated M.D.S. of the 2/8th Field Ambulance. Early in November this unit, like the others, noted the increase in incidence in malaria as more and more patients were admitted to the M.D.S. It may be noted that a diarist of this period remarked that malarial casualties were being kept in operational areas, but the wastage was none the less severe. This is true, but it was now a long time since the sending back of malarial patients to the mainland had been countenanced, and the fact

that such men were accommodated in the local units such as the 2/3rd C.C.S., the 2/3rd Ambulance M.D.S. and the 2/8th Ambulance rest camp, hardly affected the degree of wastage, though it may have partly concealed it. At the same time, the facilities for resting in the divisional rest camp allowed many men to regain enough vigour to return to their units within a reasonable period and without moving them outside the operational area. The unit's activities were next turned to the casualties resulting from the attack on Sattelberg.

The 2/11th Field Ambulance in the early part of October had closed Dorney's A.D.S. at Lae, and handed over to the 10th Field Ambulance, and on the 19th of the month embarked with the 26th Brigade Group in L.C.T., landing at Langemak Bay at night. When they arrived casualties caused by aerial machine-gunning of the barges arrived also, and were handled by Dorney and a party from the 2/3rd Ambulance, assisted by medical personnel from the 2/32nd Battalion who were near-by. Here they worked collecting casualties at a beach point and sending them by barge to the C.C.S. at Simbang whence they were sent on to Buna *en route* for Moresby. This beach post was then taken over by the 2/8th Field Ambulance, and the 2/11th set up its M.D.S. at Heldsbach plantation. This M.D.S. was designed to serve the Sattelberg-Wareo campaign and was conveniently situated, close to the harbour at Heldsbach, and near the junction of tracks to Katika, Sattelberg and Finschhafen. By 3rd November a well equipped operating theatre was erected, just in time to afford opportunities for work by the surgical team from the 2/7th A.G.H., Captains F. W. Connaughton and A. S. B. Studdy. Work could thus proceed in spite of extremely heavy rain which flooded the tents. The theatre was built of wood and iron salvaged by the R.A.E., lit by electricity and capable of being blacked out. A holding capacity of 150 beds was thought sufficient as it served a battle area, and undue expansion beyond reasonable reserve was thought undesirable.

There was little activity on local points during the next week, but the M.D.S. was expanded, and an A.D.S. under Captain P. W. Verco was set up alongside the R.A.P. of the 2/13th Battalion, in accordance with the practice found so useful previously. The road deteriorated further with heavy rain, and the road to Sattelberg was closed to traffic on the 15th. Immediately before the opening of an attack on Sattelberg, A.D.Ss. were set up with the 2/23rd, 2/24th and 2/48th Battalions. Some equipment was held in each of these, and arrangements were made for native bearers to be at a medical staging post at Kiasawa. The M.D.S. sent patients to the C.C.S. via the beach post at Langemak Bay.

The 2/8th Field Ambulance for a short time had maintained a depleted M.D.S. on Scarlet Beach after the Japanese threat, and carried on under shelter of a cliff. The rest of the unit was moved from the tense atmosphere of Scarlet Beach and assigned the useful duty of establishing and running a divisional rest and convalescent camp. Many convalescents from malaria were looked after here and enabled to rejoin their units. Many skin lesions were seen there also; the most commonly seen at the time was

a streptococcal bullous impetigo. The rest camp at first had 144 beds, but by the end of the month, Major P. A. Tomlinson had 216 beds in his charge.

The 10th Field Ambulance. A detachment of the 10th Field Ambulance accompanied the 2/3rd C.C.S. when this unit arrived at Finschhafen. In addition to its previous activities at Oro Bay and in the Buna-Gona-Sanananda area this ambulance ran an A.D.S. at Morobe and acted there as a sea-ambulance transport post. During the Huon Peninsula operations it really acted as a corps field ambulance except when detachments came under other command. Early in October Captain N. E. Brand and ten O.Rs. ran an evacuation post in Chinatown, Lae, for local patients, and then took over the 2/3rd Field Ambulance aid post and filled the role of a clearing station for Lae. During the period immediately before and during the Australian assault on Sattelberg, Wareo and Gusika, the 10th Field Ambulance continued to supply detachments for purposes of evacuation of sick and wounded. The changing battle fronts, the varied routes and methods of evacuation, by sea, land or air made this a very important function.

The 4th Field Ambulance. During November part of the headquarters of the 4th Field Ambulance came into Simbang and there, under the control of the A.D.M.S. 9th Division, engaged in work on evacuation of patients from the C.C.S. This additional help was valuable when the action on Sattelberg began.

PREPARATIONS FOR ASSAULT

On 2nd November the Allies were cheered to learn the official announcement that a landing had been made on Bougainville on the previous day by United States forces, to which the Japanese were unable to make an effective counter. The 26th Brigade had relieved the 20th Brigade on 6th November. Nine Matilda tanks were brought into the area with careful secrecy, for use for the first time in New Guinea. Morshead now assumed command of New Guinea Force, and Berryman the command of II Australian Corps.

The maintenance of supplies for the coming action was an important problem, intensified by the prevailing weather and its disorganisation of roads. Large dumps of supplies were provided, and special arrangements were made to fly 1,000 natives from the Markham Valley for special work as carriers on the supply lines. Some 600 were allotted for work with the 26th Brigade. It was of course fully recognised that there were many other difficulties to be faced, in particular those of transport and of the labour necessary for off-loading ships.

The medical units were to some extent shorn of their strength by the unavoidable dispersion of some of the ambulances to provide detachments, largely engaged in evacuation of sick and wounded. Two routes were practicable, one by barge to Buna from Langemak Bay and thence to Moresby, and one to Lae, with subsequent movement to Moresby, via Nadzab or direct. No accurate forecast of casualties could be made. During

the period of the enemy counter-attack on Finschhafen the Japanese losses had been very heavy; the 9th Division had lost 49 men killed and 179 wounded. The mounting toll of mosquito-borne disease, and the wide area over which malarial control work was needed increased that ever-present anxiety, man-wastage due to disease.

In the beginning of November more stabilisation was effected in the Finschhafen area. Clearing the Japanese from the Sattelberg track near Zag enabled contact to be resumed between the 2/13th and 2/17th Battalions, and Finschhafen itself was established as a Base Sub-area under Lieut-Colonel H. T. Allan, with Major C. H. Selby as D.A.D.M.S. A mobile surgical unit from the 2/7th A.G.H. was detached from the 2/3rd C.C.S. and was attached to the 2/11th Field Ambulance at Launch Jetty. At this time a considerable outbreak of dengue fever was encountered. The D.A.D.H. returning from an inspection of Tami Island reported that most of the sickness there was due to this cause. The 2/3rd C.C.S. was working under difficulty and was almost isolated by the nearly impassable roads of access and the flooding of Simbang Creek. The A.D.Ss. of the 2/11th Field Ambulance were set up to serve the 2/23rd, 2/24th and 2/48th Battalions, the last named being within the battalion perimeter at Kumawa with native bearers, and a staging post at Kiasawa. The M.D.S. of the ambulance sent patients by a post at Jetty Beach to the C.C.S. The remaining members of the staff of the 2/11th Ambulance arrived with their stores from G Beach. The repair of a Japanese barge enabled convalescents to be transported from the C.C.S. to the 2/8th Field Ambulance, and advanced dressing stations were set up to serve the approaching attack on Sattelberg.

The incidence of malaria was increasing. On 29th October the attack rate was 16 per 1,000, but a fortnight later it rose to 25 per 1,000. The R.M.Os. of static units were instructed to provide for the treatment of twenty to thirty men with malaria, and the congestion in the C.C.S. was such that 110 patients with malaria were sent by L.S.T. to Buna. The divisional rest station was expanded to take 350 men during the impending operations, for which medical preparations were completed on 16th November. The outline of the plan for the capture of Sattelberg and Wareo by the 9th Division provided that the 26th Brigade was to operate from the Kumawa-Jivevaneng area, using tanks. The 20th Brigade was to remain in the central sector in reserve, while the 24th Brigade engaged in vigorous offensive patrolling designed to drive the Japanese into the hills and distract their attention from the 26th Brigade. This would then give the 24th Brigade the opportunity to cut the enemy's supply line between Wareo and the coast, and further blows at communications could be dealt by aircraft and patrol torpedo boats.

THE DRIVE ON SATTELBERG AND WAREO

The 4th Brigade was despatched from Lae by small craft on 1st November and with the 22nd Battalion took over the defence of the area including Finschhafen, Langemak Bay and Dreger Harbour. As a pre-

liminary to the action the 2/48th Battalion occupied the road junction of Green Ridge and Sisi on the 16th, and the next day the brigade's advance began with an infantry move along the main Sattelberg road, supported by tanks. The assault opened with a heavy artillery barrage, and an air attack, to which the tanks added a powerful element of surprise. The roads were so cut up that patients had to be carried to Major J. L. Holme's A.D.S. at Zag; a bearer relay post in support was most helpful. The three battalions of the 26th Brigade made a simultaneous advance, and helped by the surprise of the tank attack captured Coconut Ridge and Steeple Tree Hill. Progress was slow, owing to the heavy jungle, with dense belts of bamboo confining the narrow tracks, winding over rough precipitous country. On the 19th headway was still being made, but slowly. The tracks were so slippery that help was needed from the troops in carrying wounded over the steep treacherous trail. Casualties came with a rush at one period from the "2,400 feature", one of the high points near Sattelberg, but on the 20th there were more men falling ill with malaria than wounded. Morris and Bolger were attached to the 2/11th M.D.S. as a second surgical team.

During the next two days the 2/23rd Battalion reached the Sattelberg road and the 2/48th cleared the 2,400 feature. Holme moved his A.D.S. at Kumawa back to Jivevaneng to help Verco. On the 22nd, landslides hampered movement of the tanks, but in spite of difficulties a satisfactory rate of advance was maintained. Captain J. C. Yeatman, R.M.O. of the 2/48th Battalion, was wounded. Battle casualties were few on the 23rd, but the 2/24th Battalion, though holding its positions, was not advancing. Work at the M.D.S. was increasing; 100 to 150 patients per day passed through the C.C.S., and extra assistance was obtained from R.M.Os. of the 2/2nd Machine Gun Battalion, 2/12th Field Regiment and a medical officer of the 6th Field Ambulance, who were attached for duty. Battle casualties increased in number from the infantry battalions on the 24th, and from then on were more severe in nature. The following day the Australians were showing signs of fatigue, but Sattelberg was completely occupied by the 26th Brigade on the 25th; the Japanese retreated beyond the Song River, and withdrew from Mararuo and Palanko, abandoning a quantity of equipment.

The position was much quieter on the 26th, but difficulties in evacuation had caused the numbers of wounded to increase in the forward areas. An A.D.S. at the 2,400 feature was moved to Fior, and the post at Zag was then closed. Twelve bearers were left in each aid post. Fortunately there were no casualties on the following day when the 26th Brigade was probing the country north to Fior and the Song River. The 2/23rd and 2/24th Battalions were now near Fior, but the evacuation route to the M.D.S. could only be negotiated by native bearers over long steep inclines. Captain D. C. Pope took over the duties of Captain Yeatman as the medical officer of the 2/48th Battalion. In a subsequent report Pope summed up the problems of evacuation in this action as follows:

Evacuation was often difficult from the companies and frequently there were long carries over rough country. The bearers worked excellently—several times under fire—and on one occasion were deliberately fired on when removing a patient by stretcher to the R.A.P.

Patients at times were tied to the stretchers to prevent them from slipping. It was found necessary to establish relay posts on account of long carries and the difficult nature of the terrain. The personnel of the A.D.S. were used in these relays, which were maintained throughout the action. There were eight A.D.S. personnel permanently attached to the R.A.P.: they were relieved as often as possible. No carrying was performed by natives. At times it was possible to use jeeps for evacuation of patients from companies to the R.A.P. It was never necessary to hold patients at the R.A.P. or A.D.S. Evacuation from the R.A.P. was always rapid; patients were either carried along the road or taken by jeep to the A.D.S. A jeep was on call at brigade headquarters to evacuate patients from the A.D.S. It never took longer than ten to fifteen minutes to reach the A.D.S. Evacuation was aided considerably by vehicles returning from bringing forward rations and ammunition. Canvas stretchers were used on several occasions—they were found much easier to handle if the width was decreased by 10 inches.

The incidence rate of malaria was still gradually rising, and the calls on the medical units were heavy. The remainder of the 4th Field Ambulance had rejoined the unit at Simbang a few days previously, and on the 25th, when the brigade had captured Sattelberg, the 2/2nd C.C.S. relieved from its staging task at Morobe, arrived from Godowa at Heldsbach, where it was able to open to receive patients on the 30th. This unit was welcome, as the 2/3rd C.C.S. had sustained a heavy and constant burden, increased by the rising numbers of casualties from the fighting at Sattelberg. The 2/11th M.D.S. passed on many patients to the 2/3rd C.C.S., and the 2/3rd Ambulance was able to help substantially in the holding of patients as its dressing station in the Finschhafen area, on the coast of Langemak Bay, was not functioning as a fully active M.D.S. The 2/8th Ambulance had already expanded its rest camp to meet requirements. The beginning of December saw large numbers of sick and wounded treated each day at the 2/11th M.D.S. The A.D.Ss. in support at Jivevaneng and Sattelberg were busy, the former holding a number of men convalescing from malaria. On the second of the month the M.D.S. received many sick with malaria, and battle casualties were evacuated from the three brigades. Minor casualties were moved by jeeps of the Army Service Corps, and the more severe injuries went to the A.D.S. at Sattelberg. Meanwhile the sick rate within the medical units themselves was increasing: some 70 per cent of the medical officers in the division were believed to have malaria at the end of November.

PABU RIDGE ACTIONS

During this time work at medical units was increased by operations in another sector north and east of Sattelberg, whose pivotal point was Pabu Ridge. This high point was on the line running from Wareo to the coast; it was specially important since along it ran the Japanese line of communication linking with a sea line of great value. Hence the 2/32nd Battalion was engaged in actions designed to cut it. Pabu Ridge had been subjected to constant attack by the Japanese, but the 2/32nd Battalion



(Major P. Kaye)

An R.A.P. near the Burep River.



(Major P. Kaye)

Captain P. Kaye attending casualties west of the Busu River during the Lae campaign.



(Australian War Memorial)

Australian troops landing at Scarlet Beach.



(Australian War Memorial)

Wounded being evacuated by jeep down a boggy Sattelberg track towards Finschhafen.



(Major P. Kaye)

The A.D.S., 2/3rd Field Ambulance on the Bonga-Wareo track.



(Major P. Kaye)

The R.A.P., 2/32nd Battalion at Pabu Ridge. It consisted of a shallow trench covered with timber and earth.



(Major P. Kaye)

Evacuation of a patient with a gunshot wound of the chest on the Bonga-Wareo track. Note the improvised stretcher and back rest to maintain some sort of semblance to semi-Fowler's position.



(Major P. Kaye)

Stretcher bearers of the 2/3rd Field Ambulance manhandling wounded from the 2/32nd Battalion along a jungle trail in the area north of Scarlet Beach.

took the ridge as part of the 24th Brigade's objective of the Gusika-Lakes area. The Japanese delivered a counter-attack on the 22nd; this was only partly successful, but though they suffered heavy losses from ambushes and direct attacks, they were able to cut the battalion's supply line. Captain P. Kaye, R.M.O. of the 2/32nd Battalion, pointed out that the medical services were here confronted with conditions different from those of previous operations, and summarised his experiences as follows:

> Under command for this enterprise was a detachment of the 2/3 Field Ambulance in charge of Major Dorney. This was indeed fortunate, for the battalion medical personnel were depleted in numbers. There were only four regimental stretcher bearers at the outset, and they were sorely overtaxed. Thus stretcher bearers from the ambulance were used as R.S.Bs., while the presence of a second medical officer aided the R.M.O. considerably.
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> The R.A.P. and the A.D.S. were sited alongside each other, the original medical post being simply a cleared strip of ground near the east side of the perimeter. With the advent of shelling, this was established in a shallow trench. The A.D.S. consisted of a rough shelter to accommodate about twelve patients and at the outset, this was rapidly filled with malaria cases under treatment. On the second night following the capture of the ridge, the enemy opened fire with artillery at point-blank range. Numerous casualties were occasioned, particularly in the "A" Company area, and it was 0100 hours on the following morning before the last of these received attention. Conditions at night were extremely difficult for only shadowed lights could be shown with any degree of safety.
>
> For the following ten days, the enemy repeatedly attacked and shelled the small area intensively, and our casualties mounted daily. Unfortunately, both medical posts had been badly sited and offered no protection. It seemed that both were in the direct line of fire of the enemy guns, and "air-burst" type of missile was used, attending to the wounded became hazardous and extremely difficult. Early, the enemy mortared the position and with a direct hit completely demolished the R.A.P. and killed a bearer from the ambulance detachment.

It was now essential to maintain the battalion by air-dropping, and stringency of supplies affected also the work of the medical services. When the R.A.P. was demolished at this early stage in the action, practically all medical equipment was destroyed, and for a time only dressings of make-shift type and some captured from the enemy were available. After some days air-dropping relieved the situation, and parachutes were used with great success to bring even fragile material to the beleaguered Australians.

One of the major problems of the medical officers was evacuation of sick and wounded. The risks were too great at first to send out wounded, partly because of the intrinsic dangers of the position, and partly because the native bearers could not be thus exposed. For three days, therefore, the wounded were kept in the battalion lines, attended as assiduously as possible under the close supervision of the medical officers. This nursing was performed under extreme difficulties, but fortunately only one man was re-wounded while the patients were in a relatively exposed area. They showed great fortitude in their unhappy plight of being helpless under bombardment. Native bearers were once more employed when a short and safe supply line was practicable. On the third day a company carried out wounded to North Hill, pending the execution of a plan

which aimed at capturing Pino Hill, and which was carried out successfully on 26th November. One company of the 2/32nd Battalion, with the help of the tanks, then had the satisfaction of establishing a safe line of communication to Pabu. This company had been near the Song River, taking part in the defence against the abortive Japanese counter-attack on the battalion's rearward positions, and also in the attack to secure Pino Hill. Contact was thus established with the Pabu garrison, but further measures were necessary before the enemy forces were overcome in this sector.

THE TAKING OF WAREO

After Sattelberg had been occupied by the Australians their next move was north, and their goal Wareo Spur, a prominent and important feature several miles inland from Gusika on the coast, and north of the Song River. The track from Sattelberg to Wareo ran through Palanko and Fior to other high ground at Kuanko and Peak Hill.

With additional native labour from Lae, the 4th Brigade was released from the work of unloading ships in Finschhafen and the special help of seven tanks and a detachment of an engineer special brigade was made available for an advance to Fortification Point on the coast north of Gusika. The 26th Brigade was now assigned the task of taking Wareo, and the 24th Brigade the Bonga-Wareo track, with the 20th Brigade in reserve. The 2/28th Battalion with tank support took Gusika and made further contact with the garrison at Pabu, and the 2/43rd Battalion reached the Lakes while the 2/23rd Battalion advanced north from Sattelberg and crossed the Song River and took Kuanko on 1st December. With further advance of the 2/4th Commando Squadron into the hills of Kulungtufu an important Japanese source of food supply was seized.

A few days later the Australian advance along the coast began, and in spite of strong resistance of the enemy to advances of infantry and tanks, and his occupation of log strongholds, the 2/24th Battalion outflanked the Japanese and on 8th December Wareo was occupied, while vigorous patrols pursued the retreating enemy up the coast.[2]

MEDICAL CONDITIONS AT PABU

Many of the battle casualties seen at Pabu Ridge were of serious degree. Wounds caused by large shrapnel splinters were common; they occurred in all parts of the body, and were associated with great tissue damage, and frequently with bleeding and severe shock. Compound fractures were common also, and many wounds were fly-blown; this tended to keep the wounds clean, though the patients felt some discomfort. Numbers of fatal bullet wounds of head and chest were encountered. The chest wounds were in the main of the "sucking" type, and often caused death within forty-eight hours. Two cases of gas gangrene were seen, a reminder

[2] Australian casualties for the Huon Peninsula campaign 22nd Sept 43-20th Jan 44: killed in action 32 officers, 421 other ranks; wounded in action 53 officers, 1,113 other ranks.

of how this dangerous infection always lay in wait in the New Guinea soil. Medical supplies were more plentiful once the supply line through Pino Hill was open, and supplies of drugs and dressings were obtained in greater quantity than could be expected from air-dropping. Water supply was a difficult problem; carrying parties provided a limited amount from a source 1,000 yards away. The Japanese also suffered in a similar manner, for they were using the same water point, and in order to secure it each time for their own use a covering party of Australian riflemen held the opposite bank of the stream while supplies were drawn. The supply was too restricted to help appreciably in satisfying the needs of sick patients or even in keeping the men clean. As a result "tropical" sores were common at an early stage. The general health of the men was good on the whole, apart from some malaria and dysentery, and a considerable degree of exhaustion due to both physical and mental causes. Though the men on their relief marched back to North Hill, many felt this a strain, yet thirty-six hours later, when need arose, they went into action again without hesitation. Shell dressings were not found a great success, as they did not fit on some wounded areas: vaseline gauze and sulphonamide powder were usually preferable. In spite of the extemporisations and hand-to-mouth state of supplies at certain stages, and the greatly enhanced risk of wound infection, the results were satisfactory. The lessons which emerged from this brief experience were the value of the combination of the regimental aid post with an advanced dressing station of a field ambulance, the greater efficiency of parachute dropping of medical supplies as contrasted with free dropping, and the selection of a bare minimum of equipment for an R.A.P. The sharpest lesson of Pabu Ridge was the necessity for providing all possible protection for actual and potential casualties.

COASTAL ADVANCE

After the occupation of Wareo the 9th Division was reorganised so as to permit the advance by the 20th and 26th Brigades, leaving the defence of the Wareo-Sattelberg area to the 24th Brigade. The 4th and 20th Brigades took up the task of pushing the Japanese up the coast to the north. For some time the retreating force showed stubborn resistance along the track from Wareo to Lakona, but the protection of the lines of communication by the 20th Brigade allowed the 4th to press on, and by 20th December the brigade, with the support of Matilda tanks and artillery, cleared the Masaweng area of Japanese and occupied the high features of Fortification Point. On the 21st, the 20th Brigade passed through the 4th in pursuit of the retreating enemy, and was supplied by small craft. The Japanese were then unable to do more than concentrate on their withdrawal up the coast. Their retreat was further hastened by the activity of Allied aircraft and by patrol torpedo boats. The light naval depot for these craft had been moved from Morobe to Dreger Harbour, which enabled them to operate as far as Sio. This hampered the enemy in his withdrawal, in which he could not use his own sea-craft

to advantage, in spite of his efforts in attacking sea patrols by guns mounted along the coast. Quantities of abandoned guns were seized as the victorious troops swept up the coast, which was littered with damaged barges.

On 2nd January the Australians had reached Sialum and the 126th United States Regiment then made a landing at Saidor with the purpose of securing a base from which to launch further operations by sea and air. By the 7th an airstrip was in use, and the Japanese, unable to cope with the strengthened position at Saidor were forced inland, where in the inhospitable rugged country, weakened by lack of rest and food many succumbed to exhaustion and endemic disease. On the 15th the Australian coastal force had made further advances and occupied Sio.

Colonel Dawkins had taken over from Colonel Lovell as A.D.M.S. of the 5th Division on 1st January. The 5th Divisional Command was held in readiness to take over the advance beyond Sio, and on the 16th, an advance party of the headquarters of the division came from Lae by small craft to Finschhafen. The 8th Brigade was moved from Australia to relieve the 20th; on 20th January this relief was effected, and the headquarters of the 5th Division which had been administering the Lae Base Sub-area took over from the 9th Divisional Headquarters.

The 4th Field Ambulance moved to Sialum by barge and established a beach post and an M.D.S. By midnight of the day of movement, 7th January, there were 158 patients in the M.D.S., nearly all with dengue fever. A surgical team was attached to this unit. On the 11th there were 234 patients, some with unconfirmed malaria, but only a few battle casualties. Those with malaria were sent to the 2/2nd C.C.S. at Finschhafen by schooner. Patients for the 4th Field Ambulance were picked up by jeep transport which called twice daily at the 2/15th, 2/17th Battalions and the 20th Brigade for evacuation to the M.D.S. Transport by barge was difficult at this time as most of these craft were undergoing repairs. A section of the 2/11th Field Ambulance was attached to the 2/24th Battalion, and joined another from the 2/8th Ambulance early in January to help in evacuating from Sialum. On the 13th a party of the 2/8th Ambulance reached Kelanoa Point by road, and found the beach fouled by dead bodies, an indication of the condition of the enemy's force. The 4th Ambulance on that day held 250 patients.

The 2/15th Ambulance, commanded by Lieut-Colonel L. G. Hill, arrived at Finschhafen on the 16th January, and the headquarters party went on to Kelanoa and established an M.D.S. there. By the end of the month the M.D.S. had expanded to 400 beds, and there were 160 patients mostly with malaria and dengue. The unit had a surgical team attached from the 2/7th A.G.H., and a medical consultant, Lieut-Colonel H. R. Love. Evacuation from the 2/15th was by barge, and was somewhat of an ordeal, therefore the minor sick and the seriously ill were held for a time.

Since the end of 1943 dengue had been an important cause of illness, and it was reaching epidemic proportions. Some confusion occurred with

malaria, especially when parasites appeared in the blood, but the A.D.M.S. pointed out that it could be presumed that a high percentage of troops had a suppressed malarial infection, which was brought to light by an attack of dengue.

In order to bring the Australian forces at Sio into contact with the American forces at Saidor, some union between the two had to be effected over a distance of some seventy-five miles of rough country containing some 7,000 Japanese troops. This coastal strip was narrow, intersected by many rapid streams, and rose quickly into the mountains by terraces covered with kunai or thick forest. At Kelanoa the conditions were pleasant for troops: this area came into use for troop concentration, and special attention was given to its hygienic aspects, especially malaria prevention, since this coastal zone was hyperendemic. Hookworm was almost universal among the natives, and already this infection had been found in considerable density among Australian troops returned to the mainland, particularly those admitted to hospital. Dysentery was common also in the area, but preventive measures and the use of specific medication for clinical infections reduced its importance to a low level.

The task of joining forces was not so formidable as might appear, for the enemy's morale was lowered in proportion to his physical state and his available supplies, now further threatened by the American advance. On 25th January the advance was resumed by the 5th Division, preceded by probing patrols from the Papuan Infantry Battalion. Many Japanese were found dead on the tracks, and many more were taken prisoner. Some 267 Japanese were killed during the advance from Sio, and over 1,000 were found dead. Only eight Australians were wounded; medical problems were therefore those of regional or seasonal disease.[3]

A more serious difficulty than the enemy was that of supplies for the advancing force. The weather had deteriorated with the monsoonal changes, and strong winds from the north-west raised rough seas which made it difficult for the small craft to land supplies on the beaches. In order to counter this risk of failure of food, the forward troops carried five days' rations to be used in emergency. At the end of January the medical units were disposed as follows: M.D.S. 2/15th Field Ambulance at Kelanoa; M.D.S. 4th Field Ambulance at Sialum; beach detachment 2/8th Field Ambulance at Nambariwa, and beach detachment of 4th Field Ambulance at Wasu.

On 8th February the Australians approached Saidor by land and sent an advance party by sea, and two days later the Australian force made contact with the American force at Yagomi. Patrols were sent over the inland tracks to dispose of Japanese stragglers on the flank.

At this time an outbreak of malaria was noted in the 30th Battalion; a death occurred from cerebral malaria on the 12th and another on the 14th. Dengue fever was occurring also, pointing to insufficient adult mosquito control. It was found that troops arriving at beach posts seldom had

[3] Australian casualties Sio to Saidor 21st Jan-10th Feb: killed in action 1 officer, 3 other ranks; wounded in action 1 officer, 7 other ranks.

nets, and the staff of these posts had to carry a reserve of twenty nets. The causes of this circumscribed epidemic were chiefly disciplinary; it was known that clothing rules had not been correctly followed. Experience with both malaria and dengue also showed that a frequent sin of omission was neglect of war against adult mosquitoes within individual units.

Early in February penicillin was used for a patient with septicaemia in the 2/3rd C.C.S., its first use in this unit. Investigation had been proceeding in the field units under supervision of Colonel Littlejohn along lines similar to those pursued by Dr Howard Florey. Instead of the standard method of wide excision without suture, wide excision was used with local application of 20,000 units of penicillin, dusted on with sterile sulphanilamide powder as a vehicle, and primary suture was then carried out with undercutting of the skin edges if required.

Another C.C.S. arrived during the month, the 106th commanded by Lieut-Colonel A. H. Powell, the advance party reaching the 2/2nd C.C.S. on the 13th: the main body arrived at Heldsbach on the 19th. On the 22nd, the 106th opened and the 2/2nd C.C.S. closed. During this month the 4th Field Ambulance moved from Sialum to Gusika to take over the M.D.S. and the A.D.S. at Wareo from the 2/3rd Field Ambulance. Battalions of the 8th Brigade advanced in rotation on foot along the coast, supplies and medical evacuation being maintained by small beach posts established by barge, and leap-frogging every two days' march.

On 5th March the 5th Division headquarters moved back to Kiligia and assumed command of the 4th Brigade. "A" Company of the 4th Field Ambulance, which had been in Milne Bay, was brought up to extend the rest camp: the surgical team was returning to its parent unit. The M.D.S. of the 2/15th Ambulance was now working at Kiligia. Early in April the Headquarters of II Australian Corps was ordered to proceed to Australia, after relief by the I Australian Corps. Plans were made for the 5th Division to go forward from the concentration areas to Saidor, one brigade to garrison Saidor, and one to push along the coast to Madang. Accordingly the 5th Division moved on 22nd April from Kiligia to Saidor by Liberty ship, destroyer, L.C.M. and aircraft, and some troops pressed on at once to Bogadjim and thence to Madang.

CHAPTER 10

IN THE MARKHAM AND RAMU VALLEYS

THE 2/4th Field Ambulance, under Lieut-Colonel Hobson, had been assigned the task of supplying medical care to the 7th Division in its advance to meet the 9th Division at Lae. Before the operation began the headquarters of this unit, with the addition of a surgical team, had set up an M.D.S. at Nadzab, to which casualties were for a time admitted direct. As the forces advanced on Lae the lengthening of the line of communications made A.D.Ss. necessary. As the fall of Lae became imminent the Japanese escaped through the mountains northward to the coast, and by swinging out towards the west eluded pursuit.

It was evident that the 7th Division would assume the inland role in the coming operations, which were designed to dispossess the Japanese of the vital coastal areas. This formation had the task of pursuing the enemy up the alluvial valleys which lay to the west of the Finisterre Range, and cooperating with the Fifth United States Air Force in exploiting and expanding all valuable airfields. To the east, the 9th Division was once more committed to further sea landings, and coastwise drives, with the object of expelling the enemy from the Huon Peninsula. Once his important strongholds were taken, the desirable sea-land bases of the north coast would fall into Allied hands and make possible further conquests of other island territories then held by the Japanese.

Between the 7th Division's route of advance and the coast stretched central mountain ranges, in particular the Finisterre Range, which rose to a height of 13,000 feet. This range joined the mountain spines of the Huon Peninsula, and ran up to meet the Adelbert Mountains west of Madang. Separating these systems and other ranges farther inland were the flat narrow valleys of the Markham and Ramu Rivers, flowing in opposite directions to the sea. Along these valleys lay the route to be taken by the 7th Division, with little communication on either flank, save by native tracks. Roughly in the centre of the line running from Nadzab to the coast at Bogadjim was Marawasa, for a short time the site of the divisional headquarters, and fore and aft of this central area were placed a number of strategic points. These were of great importance, as they were airstrips capable of being expanded into valuable airfields. These were Kaiapit, Gusap and Dumpu. As we shall see, however, when the route sheered off from the Ramu Valley and headed for the deep indentation made in the coast by the Bismarck Sea, there were obstacles such as attacking troops in New Guinea knew only too well, precipitous ridges capable of strong defence and needing great tenacity and force to capture.

The 7th Division also had the task of preventing the Japanese from sending a force down the Ramu and Markham Valleys towards Lae. Thus the flank of the coast forces of the 9th Division was protected, and

the development of coastal bases was facilitated. Patrolling from Nadzab had not revealed any substantial enemy forces to the north until the day before Lae was entered, when a strong Japanese force was encountered. That day the 21st Brigade arrived by air at Nadzab, and began preparations for the forthcoming advance. Meanwhile, the enemy troops were found to be retiring beyond some of the flooded streams.

Two brigades of the 7th Division, the 21st and 25th, were now concentrated in the lower Markham area; there was no intention of bringing up another brigade as this would intensify problems of supply. The same applied to some extent to the medical cover, which was to be supplied by two field ambulances, Hobson's 2/4th and the 2/6th commanded by Lieut-Colonel R. J. Humphery, with the addition of surgical teams if required, and of course with the routine services of the R.M.Os. The 2/4th Ambulance had been brought up to strength several days before the fall of Lae by the arrival of its remaining staff by air at Nadzab. Posts were established at Boana and Yalu, and Majors E. H. Goulston and E. S. Stuckey were detached as a surgical team to the 2/6th Field Ambulance from the 111th C.C.S. Already there were shortages at Nadzab. There were not enough stretchers for all the patients who were evacuated by air to Dobodura and some were sent on palliasses until supplies arrived by returning planes from Dobodura. The M.D.S. was set up in the Gabmatzung Mission area, chiefly using tents and native huts: one large mission hut was very suitable for an admission and resuscitation centre. An A.D.S. was established on the No. 1 strip. Some of the blood arriving from Moresby was not fit for use, and on 28th September Brigadier Furnell, D.D.M.S. New Guinea Force, visited the unit and discussed blood bank arrangements.

After Lae fell the incidence of endemic disease was noted to be increasing; the 2/4th Ambulance was kept busy with sick from the 25th Brigade, chiefly owing to dysentery and pyrexia of unknown origin. This was not unexpected, as the river valleys and lower slopes of the higher ground were known to be malarious, both by reputation and by local surveys. A week after the entry into Lae the admissions to the M.D.S. at Nadzab for the previous fortnight numbered twelve officers and 277 O.Rs.; of these 87 had proven malaria, six being of the M.T type. More patients with the original diagnosis of P.U.O. were being proved to have malaria; 150 men with proven malaria were admitted to hospital from 9th to 27th September, and the proportion of M.T. was increasing. More cases of typhus also were emerging from the indeterminate class of P.U.O.

ADVANCE ON KAIAPIT

The next move was an advance on Kaiapit. As a preliminary, on 17th September the 2/6th Australian Cavalry (Commando) Squadron[1] was flown to an emergency landing ground west of the Leron River, a tributary of the Markham, and joining with a company of the Papuan Infantry

[1] The name of the Independent Companies was changed in September 1943 to Commando Squadrons. The headquarters units became known as Cavalry (Commando) Regiments.

Battalion, moved on to reach Kaiapit on the 19th. Vigorous attacks thrust a hostile enemy force back from one village, and on the next day from other villages also. On the 20th Kaiapit was in Australian hands in spite of a heavy Japanese attack, and men of the 21st Brigade were landing from transport aircraft on the airstrip. Further troops arrived from Nadzab and the position was soon secure. Next day battle casualties were flown from Kaiapit by a transport plane of the Fifth American Air Force; the same day the headquarters of the 2/6th Field Ambulance arrived at Nadzab by air. With the addition of a surgical team this party was sent to establish an M.D.S. in a coconut plantation near Kaiapit, while only a small ambulance detachment moved with the 21st Brigade. The 2/16th Battalion of this formation came into sharp conflict with a Japanese force, and crossed the Umi River, a tributary of the Markham, with difficulty on 24th September. Sagerak was captured, but as the objective, Marawasa, was still some distance ahead, Brigadier I. N. Dougherty waited for the 25th Brigade to arrive before moving on. Therefore the force recrossed the swift Umi River while the 25th Brigade flew from Nadzab in three days and took up the defence of Kaiapit. The 21st Brigade then crossed the Umi on a chain of rubber boats, such as was used to cross the Markham River, ferried over two 25-pounder guns, and by the 30th had reached Marawasa.

MOVEMENT TO GUSAP

An advance party explored up the Gusap River without sighting the enemy. Medical care of so mobile a force presented some difficulties, but was successfully carried out with small detachments. After conference between Dougherty and Humphery it was decided to call forward another surgeon to deal with urgent casualties. Goulston with a small party set up a post at Wankon on 30th September, and next day went on to Gusap. This provided for the holding of patients should the casualty rate increase, and should the weather prove bad for flying.

Meanwhile the 2/6th Commando Squadron guarded the brigade's right flank. The leading battalion patrolled the river while the rest of the brigade cleared the tall kunai and prepared an airstrip, so that the divisional commander, Major-General Vasey, was able to land at Gusap on 1st October in the first transport plane, and established his headquarters. By the 3rd the 21st Brigade was forward at Gusap River, and was evacuating patients by air. Goulston's section sent out 136 casualties in five days in spite of meagre facilities. The arrival of the 2/2nd Pioneer Battalion with part of the 2/4th Field Regiment freed the 25th Brigade of its defensive role, and enabled it to come forward and deal with enemy stragglers, while the 21st Brigade went on towards the next objective, another airfield at Dumpu.

The movement of a large body of troops from Kaiapit enabled the 2/6th M.D.S. to evacuate its patients to the 2/4th Ambulance's M.D.S. at Nadzab. Hobson received warning that 120 patients would be sent back from Kaiapit and this accomplished, the 2/6th quickly packed in prepara-

tion for its move up the Ramu Valley, and was flown to Gusap shortly after the airstrip was ready for traffic.

The 2/6th Ambulance still lacked some of its men, but now that further medical help was needed by the two brigades, two of the ambulance's bearer companies were sent from Moresby, to arrive at Nadzab just in time for each plane load to be sent on to Gusap on 5th October. This unit was now complete and assembled in the Gusap area, but, as was characteristic of this type of warfare, detachments were sent on various missions. The detachment assigned to the 21st Brigade moved with it down the Ramu Valley, and posts were established on the Ramu River near the landing strip. The level of work at the Kaiapit M.D.S. remained fairly constant at this time: on 3rd October there were 118 patients there; ten others were sent back by air from Gusap River, and twenty-seven from Gusap. The A.D.M.S., Colonel F. H. Beare, wished to evacuate the Gusap post, but the steady influx of patients prevented this.

ADVANCE INTO THE RAMU VALLEY

Full advantage was taken of the lack of opposition by the Japanese, and the speed of the Australian movement continued. At Bena Bena, to the west of the Ramu River, a protective force with Captain McCracken as R.M.O. was stationed, and was engaged in active patrolling in the upper Ramu Valley. No sign had been seen of the enemy between Kaiapit and Bumbum since 24th September, and a week later the 21st Brigade had advanced from Kaiapit into the Ramu Valley. Captain N. B. Wilmer accompanied the 21st Brigade headquarters to Dumpu and established a post there; Major T. E. G. Robertson also had a staging post working at Kaigulin. At Gusap Captains A. L. Hellestrand and F. D. Smith were still very busy, and the number of patients held was increasing, largely owing to the very heavy rain which flooded the Gusap River and washed away a bridge.

Dumpu Base Established

On the 5th, Humphery's headquarters arrived at Gusap and brigade headquarters reached Dumpu. The ambulance headquarters was unable to locate the brigade in the gathering darkness, and had to return to the Surinam River until the next morning. Already there were some severe casualties and the team under Major J. Loewenthal was brought up to save them the trying trip back to Gusap. Troops of the 2/16th Battalion had difficulty in fording the swiftly-flowing Gusap River, but were able to cross with the aid of a life-line at the junction with the Ramu River, while the engineers built a log bridge. At Wampun there was firm resistance by the enemy; the 2/14th Battalion had a sharp struggle in which Lieut-Colonel R. Honner was wounded, but Dumpu was taken. Dumpu was an important centre with a large airstrip, and its capture facilitated air evacuation and lessened difficulties of land movement over flooded streams. By 5th October the 21st Brigade had a sound defence achieved at Dumpu, and the 25th Brigade was moving forward.

MEDICAL ARRANGEMENTS

The 2/6th Field Ambulance was able to move on from Gusap by jeep and on foot, the headquarters established an M.D.S. at Dumpu, and surgical teams were attached to the posts at Gusap and Dumpu. From the 9th onwards the divisional headquarters and troops moved into the Dumpu area. The post at Kaigulin 1, a little south of Dumpu on the Ramu River, was used by the reserve brigade for evacuations of a few sick and wounded, but the majority were sent to the M.D.S. at Dumpu. Here landing strips were cleared and work carried out on a road to Kumbarum. Within the next few days patients were arriving faster than shelters could be provided for them. The M.D.S. at Dumpu was holding 245 patients; all but minor casualties were returned from Dumpu No. 2 strip by air to Nadzab. By this time the line from Dumpu to Kumbarum along the Uria River was firmly held by the 21st Brigade. From the river crossing a track led to Bogadjim on the coast. Bena Force, consisting of the 2/2nd and 2/7th Commando Squadrons, had been brought up, and engaged in extensive patrolling. A battalion of the 21st Brigade was also placed a few miles farther on across the Bogadjim track. The divisional headquarters was established at Dumpu, and the 25th Brigade was concentrated in the Ramu Valley some miles to the north-west.

The 2/4th Field Ambulance was still running the M.D.S. at Nadzab, and awaiting relief so that the unit could move forward. On the 7th problems of hygiene were causing some difficulties, and native labour was scarce, but two days later more anxiety was caused when the first patient with cerebral malaria died. The 2/4th M.D.S. was then holding 368 patients. Meanwhile the 2/6th Ambulance was busy at Dumpu, where a grass hut had been constructed to house surgical patients and on the 9th an operating theatre was complete and working well. On the 11th an advance party of the 111th C.C.S. with Major J. F. Cobley, arrived to take over the M.D.S. site at Nadzab from the 2/4th Field Ambulance. Two days later the commander, Lieut-Colonel W. E. E. Langford, and the rest of the C.C.S. arrived and immediately began work, formally taking over at Nadzab on the 18th.

By the next day "A" and "B" Companies of the 2/4th Field Ambulance had arrived at Dumpu strip and a detachment was sent from "A" Company to go with the 2/33rd Infantry Battalion to form a post in the foothills under Wilmer, while Captain J. C. Church took another party of ten men to Guy's post, supporting the 2/27th Battalion.

A number of defensive posts were established on the ridges; these were important not only for purposes of defence and observation over the coastal area, but were also valuable for the purposes of the medical services. Guy's post, to which Church had taken his detachment, was favourably sited on a plateau overlooking the Faria River. It developed into an efficient medical staging post two and a quarter hours from brigade headquarters, where the R.M.O. of the 2/14th Battalion, Captain H. M. Stevenson, had established his R.A.P. The 2/27th Battalion R.A.P. run by Captain W. Gove was close to Church's post and the R.M.O.

of the 2/16th Battalion, Captain H. R. Hodgkinson, had his R.A.P. on top of a 2,500 foot ridge about two hours farther up the Faria Valley.

On the day when the Guy's post party arrived seventy-one patients were in the M.D.S.: an order was received that the unit would if necessary hold up to 500 patients. All equipment and supplies were scanty, particularly tents and cooking gear. On the 13th patients had doubled in number and battle casualties kept the surgical team working all night. The next day 245 patients were held and thirty natives were clearing scrub and erecting wards and shelters as fast as possible. Tents and flies had to be used separately: they were rotten and could not keep out the rain. Grass huts, made after the Papuan fashion, with folded grass were more satisfactory, and were put up with all speed. The diarist of the 2/6th Ambulance remarked that in the 7th Division there were at least six senior medical officers who had had a similar experience in having to accommodate numbers of patients far beyond the capacity of a field ambulance, but without equipment adequate in type or amount. The evacuation of 110 patients on the 15th reduced the numbers in the M.D.S. to 174, but next day they rose again to 238.

At this time, with numbers beginning to mount in the M.D.S. and seasonal endemic disease increasing in impact, the unit commander pointed out that a breakdown might have occurred earlier but for the outstanding work of two officers in charge of small sections. From the time the 21st and 25th Brigades left Kaiapit till their arrival at Kaigulin 1, the forward medical support depended entirely upon these two officers, Wilmer with a light section of ten men, and Goulston with a light section of nine men. They evacuated some 400 sick and wounded efficiently over a long and rough line of communication, in spite of the difficulties imposed by the speed of the force's movement. However, the military position was favourable, and permitted the necessary airfields to be constructed for the Fifth United States Air Force, and the remaining brigade of the 7th Division, the 18th, which had not been needed, had been kept in reserve in Moresby. Early in October the Fifth Air Force was operating from the airfields at Nadzab, Kaiapit, Gusap and Dumpu. The protection of these airfields and installations was one of the important functions of the 7th Division.

More intensive campaigning lay ahead. The Japanese were exploiting the natural defences of the mountainous country linking the Finisterre and Adelbert Ranges. From Dumpu and Kumbarum on the Uria River the only available trail to the coast was difficult: after crossing the Faria River, a tributary of the Ramu, it climbed up over precipitous ridges of which Shaggy Ridge was to become the most famous. On this mountainous area the Japanese had constructed four miles of defences along this steep spur which ran parallel with the Faria River. From the coastal side they were making a rough road capable of carrying motor traffic up to a point where the track crossed a high division of two watersheds, with the Faria on one side and the Mindjim River on the other. The Mindjim entered the sea near Bogadjim between the seawards slopes of

the Finisterre and Adelbert Ranges. The divide of the two rivers was the highest point on the route leading from Dumpu to Bogadjim, and was known as the Kankiryo Saddle. In this steep and rugged country lay the scene of the next encounters with the Japanese. Once more assaults would be made on precipitous peaks, as so often before in these campaigns, and again would the medical services be called on to work in the small detachments which had proved so successful.

During the remainder of October the medical work centred round Dumpu. The C.C.S. had some initial troubles with rations for the sick. Hobson's field ambulance had an arrangement with the 7th Divisional command which gave them some priority in the supply of fresh food, but the C.C.S. was not under divisional command and was not so favoured, and had difficulties with the dietary until matters were adjusted by the D.D.M.S. of New Guinea Force on visiting the area. The attachment of a catering officer was also of great assistance to the unit. On the 17th a malarial control unit arrived, rather belatedly, as its presence would have been valuable at a considerably earlier date.

The next evening was one of intense discomfort in the M.D.S. Heavy rain flooded the wards and as most of the patients were lying on the ground, they were soaked by muddy water which could not be successfully diverted. Humphery wished for American light "camp cots" for the men, reflecting that they were lighter and better than stretchers, which in any event were seldom available in sufficient numbers. Medical stores were being used at double the normal rate; on the night of 19th, 385 men were in the M.D.S., on the following nights 458 and 499.

Patients continued to arrive in such increasing numbers, that Majors E. J. C. Molesworth and Love and Captain W. P. Ryan were sent to assist. The A.D.M.S. ruled that "temporary" tented wards were to be erected, but little grass was available for huts and no tents arrived. Finally, just sufficient shelter was provided in grass huts before darkness fell, and at the cost of crowding, all the 637 patients in the M.D.S. were under shelter.

Most of the admissions were men with malaria: there could be no doubt that the epidemic had arrived, though its full extent among the febrile patients could not be ascertained, as there were only restricted facilities for malarial diagnosis at that time. Several officers of the unit had malaria, and others though not clinically ill had parasites in their blood. Cooking presented a colossal problem. Pioneers helped to construct more wards, but on the 26th there were 737 patients. On the 28th, Humphery had 805 patients in the M.D.S., this meant feeding over 1,000 men for breakfast: he claimed, no doubt with justice, that this constituted a record for patients held in any field ambulance in this war.

This peak of admissions was reached at Dumpu, in the 2/6th Field Ambulance, and as evacuation was better organised with control of the airfields, the patients were sent farther back if possible or returned to their units. However, a high proportion of M.T. malaria was noted among the admissions and it became evident that in spite of the use of atebrin as

a superior suppressive, the possession of a non-irritant and effective repellent in dimethyl phthalate, and all the force of official mosquito control, education and propaganda, the division was faced with an increasing problem in an epidemic of malaria. In the middle of October surveys were carried out by Major English, malariologist. Captain R. N. McCulloch also made surveys of mites in the area, and gave demonstrations of the correct method of using "Betty" or di-butyl phthalate, the mite repellent. The A.D.M.S. arranged for the 2/6th Field Ambulance to close down, leaving the 2/4th to take all patients from the brigades. The 2/4th on the 22nd was holding 300 patients, a number which rose to 445 by the end of the month, though over 100 patients had been sent back, and a transit camp had been established near the end of strip No. 2, which was nearing completion on the Dumpu airfield. This camp gave convalescents opportunity to rest and to be re-equipped before returning to their units, and eased the demands on hospital beds. The position was made more difficult by bad weather, which made flying dangerous or impossible. Beare instructed that the 2/6th M.D.S. should take no more patients for the present, as it was shortly being transferred to a new site near the Mene River. Some discussion took place over this change, particularly with regard to the questions of dispersal and security, should the enemy attack one of the airstrips; the movement was not completed until 6th December. An arbitrary limit of 500 admissions had been imposed on the field units, and this was not passed by the end of October; the 2/4th M.D.S. was then reduced to 150 and the 2/6th to 50 patients. At the end of October reinforcements arrived for the two brigades which were in the foothills making good some of the losses caused by illness, and patrolling was actively pursued in the Faria-Uria sector.

There was a more static disposition of the forces in the Ramu Valley; this permitted detachments to man some of the advanced medical staging posts, such as Guy's post. This covered the 2/27th Battalion's position, and was distant some three and a half hours of steep climbing from Shaggy Ridge. The enemy made no attempt to advance, but exploited the suitability of the terrain for defence, probably because he was heavily committed in the coastal area.

Nevertheless all due care was observed in the siting and layout of the medical units. At the beginning of November the second airstrip had been completed at Dumpu and was used for air movement of all sick and wounded, as it was only half a mile from the 2/4th M.D.S. Occasional bombing attacks occurred in the Dumpu area; one bomb thought to be a 250-pounder fell 400 yards away, but no damage was caused. Divisional command did not approve of red cross ground signs, and asked that slit trenches be prepared. Incidentally the dispersal which was necessary to some degree in areas threatened by air attack added appreciably to the strain on the staff, as had been evident during the Middle East campaigns.

The 7th Division came under direct command of New Guinea Force on 6th November, and II Corps was freed of responsibility in the Ramu

Valley. The 25th Brigade relieved the 21st in the Faria-Uria area, and the 21st took over the Mene area. Arrangements were confirmed for the 2/4th Field Ambulance to take over the medical posts previously manned by the staff of the 2/6th.

New Atebrin Instruction

A highly significant medical instruction was promulgated from Land Headquarters on 29th November. This laid down that all troops of the 7th Division should take two tablets of atebrin for six days a week. This was at once a clear declaration of the importance of controlling the epidemic of malaria and of lessening of the wastage of men through illness which still beset the division.

Meanwhile, active patrolling was maintained in the forward areas, but the military position remained static for some weeks, though contact was made with the enemy throughout the period. From the post on the high ground of the Finisterres observation could be constantly maintained over Madang Harbour and the Japanese activities up to Bogadjim, while the air force maintained pressure over the enemy lines of communication. At the end of November the 21st Brigade took over the role of the 25th again, and though enemy attacks were made from time to time, nothing on a large scale occurred. It was evident, however, that a major action was likely to take place before long.

Early in December, Australian commandos were protecting the air installations in the Ramu Valley and keeping the enemy under observation, while patrols were actively moving to the west of the Faria and Uria Rivers in the Kesawai area. This activity flared up into a sharp encounter on the night of the 7th-8th in which the Japanese lost heavily, though the 2/6th Cavalry (Commando) Squadron was forced to withdraw. The medical post of the 2/4th Field Ambulance at Evapia evacuated to the eastern bank of the Mene River, and as there was a threat of a Japanese push down the valley, 192 of the M.D.Ss.' 327 patients were sent to Nadzab by air on the following day. Captain R. Row, R.M.O. of the 2/6th Cavalry Squadron, was re-equipped from the M.D.S. as his R.A.P. gear had been captured. This unit was strenuously engaged during this period and exposed to conditions of great physical and mental strain. Kesawai, surrounded by a number of old native villages, was a very bad area, and produced a large number of malarial casualties. It was also infested with the mite vectors of scrub typhus. Two companies of the 2/25th Battalion with artillery moved into the area, and were soon engaged in action, with the 2/4th Ambulance medical post at Evapia again in support. On the 13th the Japanese made a determined attack, but though the Australian forces were seriously reduced in strength by casualties from wounds or infectious diseases, they repelled the Japanese force, which withdrew from the position. Air attacks also helped to reduce the enemy strength; the position forward along the valley was now consolidated, and with larger operations threatening, the Japanese strong raiding parties retreated to their base areas.

ACTION AT SHAGGY RIDGE

The time had come to bring matters to a head at Shaggy Ridge, where the enemy had concentrated and had set up strong defences on this formidable razor-back. Three steep elevations arose from this ridge, known as "Pimples" to the Australians; they were called, serially the Pimple, Intermediate Sniper's Pimple and Green Sniper's Pimple. These had the strength of their natural conformation enhanced by fortified posts and foxholes. In preparation for the attack on the southern end of Shaggy Ridge, Captain W. P. Ryan set up an operating theatre at the 2/4th Ambulance Lakes A.D.S.; Captain J. B. F. Tucker proceeded to the 21st Brigade for onward movement to form a medical staging post for the 2/16th Battalion. This battalion began the main attack on the Pimple on the 27th December after intensive fire by the 2/4th Field Regiment's 25-pounders, and dive-bombing and strafing by Allied aircraft. The infantry tackled the arduous frontal assault, struggling up the steep track with sheer rocky drops on each side. After great difficulty they established a position on the Pimple, and held this against stout resistance. On this precipitous terrain supplies were taken in and casualties taken out from forward positions with great effort; the bearers scarcely had room to negotiate their burden on the narrow way between the steep rock faces. Ten wounded were evacuated with an average time of four and a half hours from the ridge to the Lakes A.D.S.

The preliminary battle was but the beginning of a series of actions which were bitterly contested on both sides on the narrow Kumbarum-Shaggy Ridge front. There were still further elaborate preparations to be made, roads constructed, tracks made and reserves of supplies stored. The third brigade of the 7th Division, the 18th, which had been in Moresby, was flown forward to take over from the 21st Brigade in the Shaggy Ridge area. The 15th Brigade was also flown into the Ramu Valley to relieve the 25th Brigade in the Kesawai area to the west. Extensive planning lay ahead so as to prepare for encircling movements to capture the strongholds on the left flank and on the north-western side of the ridge.

The 2/5th and 15th Field Ambulances were brought up in medical support of these formations. The 2/5th Ambulance, which had been held in reserve in Moresby during the previous activities of the 7th Division in the Markham and Ramu Valleys, arrived by air at Dumpu on 4th January under Lieut-Colonel A. M. Macintosh, in readiness to service the 18th Brigade, which flew in on the following day. Parties from this ambulance took over the A.D.S. near the brigade position, the medical post of the Kumbarum convalescent camp, the A.D.S. at Guy's post, and other posts such as Geyton's and Beveridge's. Bearer sections were stationed near Grassy Patch and also at the R.A.P. of the 2/2nd Pioneer Battalion.

On 5th January the 15th Brigade took over from the 25th Brigade at Kesawai, and on the 8th, Lieut-Colonel Refshauge and the 15th Field Ambulance arrived by plane at Dumpu. Here this ambulance took over



(Australian War Memorial)

A forward surgical post in the Orgoruna area, Ramu Valley.



(Australian War Memorial)

At a mobile surgical team's headquarters, Kumbarum.



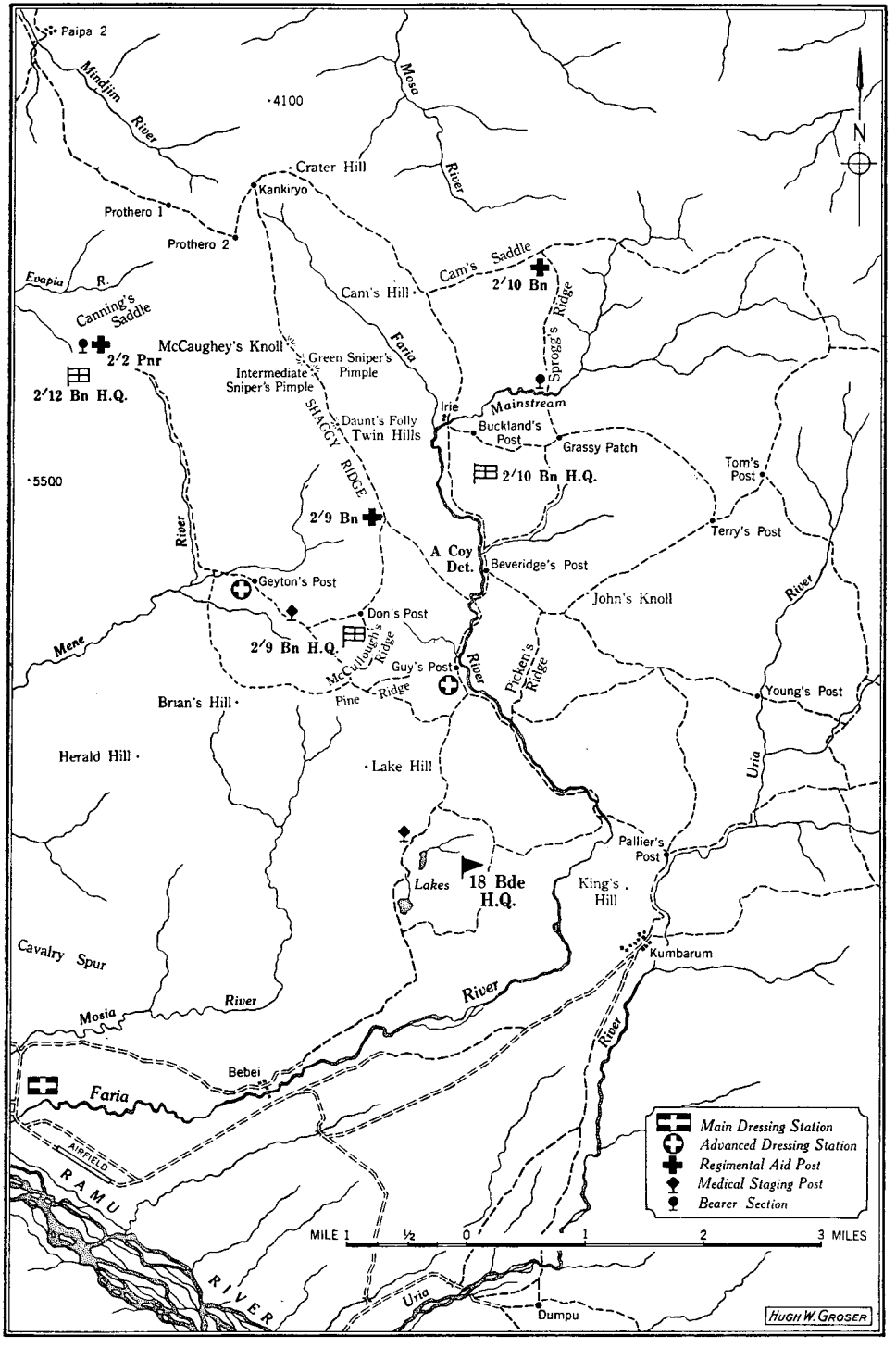
(Australian War Memorial)

Evacuation by plane from Nadzab.



(Australian War Memorial)

Preparation of patients for air evacuation from Nadzab.



Shaggy Ridge

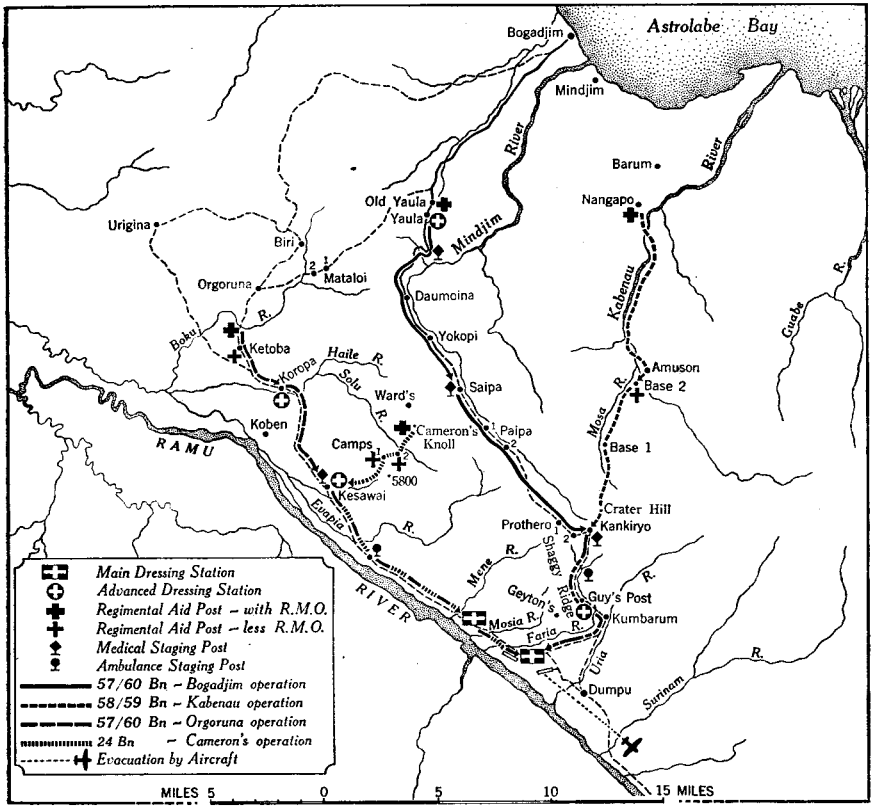
the M.D.S. at the Mene River which had been run by the 2/6th Field Ambulance. The pending Australian attack was to be delivered by the 18th Brigade. As in many other engagements the battle was for the heights. Shaggy Ridge, and in particular the Kankiryo Saddle, were the objectives, as they commanded the track which led to Bogadjim on the coast, a vital link in the chain of supply. Three high features on the ridges Prothero 1, Prothero 2 and Kankiryo were of tactical importance. The 18th Brigade's object was to expel the Japanese from their strongholds on this higher ground, and to command the track to the coast. In token of the recognition of the true significance of this action, the code name given to this operation was "Cutthroat". The first phase was one of patrolling to the north, and of raiding and harassing the enemy, the second that of capturing Kankiryo Saddle using surprise as a necessary part of the manoeuvre.

MEDICAL ARRANGEMENTS

The brigade commander, Brigadier F. O. Chilton gave details of the military plan to Macintosh for a medical appreciation, which was submitted also to Beare. The medical plan for this action was based on a three-battalion front, as the brigade was to be committed without reserve. It provided for evacuation by ambulance bearers from the R.A.P. and native bearers to the jeephead, where wheeled transport was available. Arrangements were made so that wounded could be operated on within six to eight hours, and held for two to three days if necessary. A surgical team of two surgeons was ready and could be sub-divided if circumstances demanded. The A.D.M.S. did not agree with all details of these recommendations, but the general plan was adopted. A surgical team was placed at Geyton's post; an A.D.S. was retained at the Saddle, and the bearer section moved with the 2/10th Battalion. It was recognised that heavy rain might at any time make the road impassable between Guy's post, the Saddle post and the M.D.S. at Mene River. Captain Ryan of the surgical team was at the Guy's post A.D.S., where the first patient was operated on for acute appendicitis. Edelman went to Guy's post, and Leggett to Geyton's post. Geyton's A.D.S. was set upon a broad ledge above the Mene River, with adequate cover from air observation and a good water supply. The surgical ward was built from half tents on a framework erected by natives. A small medical ward was built and roofed with a half tarpaulin. Captain J. Rutherford was in charge of the section with Leggett running the surgical team.

The troops in the 15th Brigade area were not involved in the first attack, but had some opportunity for enlarging their experience of the type of country. The R.M.O. of the 57th/60th Battalion, Captain M. G. Gratton, noted considerable numbers of cases of dengue fever after leaving Dumpu and at Ketoba saw men with unconfirmed malaria. At Orgoruna and the forward areas there had been a good deal of fouling of the ground by the Japanese, and in spite of instructions to the contrary, some of the men used unsterilised water for drinking and other purposes, thus pre-

cipitating an outbreak of clinical dysentery. Many men suffered from abraded feet, made worse by lack of daily inspections by platoon commanders. The R.M.O. found it convenient to use his medical companion mainly as a container: his essential stores included two Thomas splints, the usual dressings and drugs, with a 10 c.cm. syringe and ampoules of



"Pentothal". Sulphaguanidine tablets were available in the aid posts. To ensure that the post would be freely mobile the R.A.P. staff carried a one-man tent, and could set up without delay. Native bearer teams were ready to carry from Boku River to the A.D.S. at Koropa and to the M.D.S. at Kesawai. The medical officer found the unit to be very malaria-minded: nets were used except by one company during an attack, but no destruction of mosquito adults or larvae was carried out forward of Koropa. Only nine confirmed cases of malaria were recognised; other fevers were observed and were thought to be due to dengue, but health was good on the whole.

Meanwhile, the 18th Brigade began its action. The plan employed three columns, the 2/9th Battalion along Shaggy Ridge, the 2/10th

on the right and the 2/12th on the left flank, where the main attack was to be delivered. A wide encirclement was planned on the left which would sweep round the Mene River area and the feature known as Canning's Saddle. Preparatory work was secretly carried out on new tracks, and artillery fire and air strikes were used to cover the movements of concentrating battalions. Some of this preparatory work emphasised the problems facing the medical services; for example the 2/12th Battalion, travelling over ravines and cliffs with the help of ropes and vines, took three days to cover nine miles.

Final medical arrangements included additional help at Grassy Patch; the distance from battle headquarters was a three hours' carry, and therefore some wounded would need to be kept overnight. Further assistance was available from the 15th Field Ambulance. Throughout the night of 19th January, planned for the beginning of the attack, torrential rain fell, washing away six out of seven bridges between Guy's and Beveridge's posts, and the main bridge between Guy's and the M.D.S.

CONTINUED ACTION ON THE RIDGE

At 9 a.m. on the 20th the artillery opened fire as a prelude to the infantry attack. Macintosh managed to reach the combined post of the ambulance and the 2/10th Battalion at Grassy Patch, found the track greatly damaged, and the river crossings very difficult. In these areas the recovery of wounded involved clambering up slippery slopes and walking through streams. The morning of the 21st was spent completing the fitting of the wards at Guy's post. Two huts had been constructed, one for use as an operating theatre, the other as a surgical ward. The first casualties were received during the afternoon, and came in a continuous stream from then on. The team worked throughout the night; Refshauge sent another medical officer to help at Guy's post, and also an N.C.O. and eight O.Rs. to "Damour" bridge to ferry patients across the flooded Faria River, where the bridge had been washed away. Two days later another section went to the Evapia River on ferry service.

Casualties were reported from the 2/12th Battalion, but owing to prevailing conditions in the forward areas not all of these reached Geyton A.D.S. but were kept at the forward R.A.P. and M.S.P. run by Captain I. H. Chenoweth of the 2/2nd Pioneer Battalion. Some patients arrived at Geyton's as long as thirty-six hours after wounding and showed evidence of exposure and strain of travelling. Difficulties were also encountered in moving wounded back to Guy's from Geyton's post. Evacuation of lying cases from A.D.S. Geyton's to A.D.S. Guy's was by native bearers, the carry varying from three to four and a half hours. Walking casualties, taking with them one meal for the trip, reached A.D.S. Guy's in five to six hours after departure from Geyton's. The advance of the 2/12th Battalion up the feature Prothero 1 presumably surprised the enemy, who had been firing on the 2/9th Battalion on Shaggy Ridge. The forward elements of the 2/12th Battalion, when almost at the top were exposed to point-blank fire. Here Lieut-Colonel C. C. F. Bourne, their commander

was wounded with many of his men. Nevertheless the 2/12th succeeded in driving off the Japanese from Prothero 1.

On the right flank the 2/10th Battalion dislodged the enemy from his defences on the western end of Cam's Saddle. It was expected that Captain W. J. Pullen's ambulance section would be required to join with Captain H. G. Royle in holding casualties. By nightfall the 2/9th Battalion had secured Green Sniper's Pimple and they established contact with the 2/12th next morning. The Japanese were cleared from Shaggy Ridge, but Macintosh considered that the route over the ridge with its precipitous fall on both sides was not fit for carrying casualties.

The next day the action to capture the high feature "4,100" was begun, the prize being command of the Kankiryo Saddle. Captain C. R. Copland, R.M.O. of the 2/9th Battalion, moved up towards Kankiryo Saddle along Shaggy Ridge on the 25th. During this afternoon a steady stream of casualties arrived at Guy's post from both the 2/9th and 2/12th Battalions, and a medical post from the 2/5th Ambulance was established by Captain W. Arrowsmith near the junction of Mainstream and Faria Rivers. While returning from visiting the forward R.A.Ps. of the 2/9th and 2/10th Battalions his party was fired on, but without damage. During the next few days heavy and persistent fighting continued against an enemy strongly entrenched in formidable defences. Progress was made on the Faria Spur, but was held up on the 4,100 feature, where resistance was still strong. However, fighting continued on the battalion front, helped by artillery, and Japanese counter-attacks failed to prevent the Australians from capturing the Kankiryo Saddle, though the enemy was still concentrated on the same feature overlooking the divide. It was, of course, most important that this high point should also be captured, for not only did it look out over the Mindjim watershed, but in fair weather a good view could be obtained of the coastline and the shipping that congregated in the harbours.

Native carriers did very good work during these actions, and members of fighting units too had to help with transport. In places the ground was steep and slippery, to such an extent that members of the 2/5th Ambulance detachments sometimes had to pull themselves up with ropes tied to trees. These ropes were also found useful in carrying loaded stretchers over this type of country. During the struggle for the Kankiryo Saddle a few casualties had to be taken from the bottom of a steep declivity at the base of the ridge. This was too precipitous even for a native carrier team, and was sometimes under fire. Some seventy men of a company of the 2/12th Battalion under directions of their R.M.O., Captain J. M. McDonald, took the stretchers up the hill by passing them up a chain of two rows of men to Shaggy Ridge, where ambulance bearers and finally native carriers took over at the aid post. Many of the stretchers were improvised, and to make them and to keep patients warm, half blankets and ground-sheets were fastened together with twine and Japanese signal cable. In spite of fatigue, members of the ambulance detachments were often too cold and wet to sleep.

Colonel Littlejohn, Consulting Surgeon, visited Guy's post on the 29th January and stayed overnight in order to make some experiments with penicillin in the field. By 1st February many sick were reporting from the battalions, mostly suffering from undetermined fever and diarrhoea. Some of these men had been working under conditions which gave them no facilities for washing either themselves or their food containers for periods up to a fortnight.

While the main attack on Kankiryo was being prepared and delivered, a diversionary movement was made on Cameron's Knoll by the 24th Battalion. Further medical aid was arranged by the 15th Field Ambulance when Captain D. C. G. Bracken set up an A.D.S. in the Kesawai area and Major J. J. Ryan arrived to work as surgeon. During a brief lull the 18th Brigade regrouped its elements in preparation for a final attack. On the 31st the Japanese showed signs of weakening, and by the next day the last objective, known as Crater Hill, was taken with guns and useful equipment. Aggressive patrols of the 2/9th Battalion followed the enemy in his retreat down the Mindjim Valley as far as Paipa. After attacking the forward areas at Orgoruna and Mateloi the 57th/60th Battalion withdrew to Kesawai. The A.D.S. was moved from Kesawai, leaving a medical staging post there, and was set up at Koropa.

Though there was still much to be done to stabilise the position, the object of the operations was achieved. Shaggy Ridge and Kankiryo Saddle were wrested from the Japanese, and the way lay open to the coast at Bogadjim. Supplies were still a difficult problem, and there was great need of improved roads forward of Dumpu to Kesawai.

The casualties of the 18th Brigade were 46 killed and 147 wounded, but the Japanese had lost many more; 244 of their men were buried by the Australians. After this action the enemy made no concerted stand, and abandoned quantities of stores, but in some areas he still put up resistance. Early in February active patrolling was carried out, and the divisional commander ordered the 15th Brigade to relieve the 18th. The arrangements were made mutually by the two brigades, the headquarters completing the exchange on 18th February. Defences and tracks were strengthened and improved, and long-range patrols were begun. In these activities the 58th/59th and 57th/60th Battalions gained valuable experience and built up a better topographical knowledge of the area which comprised Mindjim Valley and Kabenau River and led to Bogadjim and Madang.

Sickness rates were low at this time, and malaria control measures were being successfully carried out according to orderly methods. The 15th Brigade showed a satisfactory incidence rate, considering the conditions, and profited by the routine adoption of special precautions, and by the insistence of the commander in their implementation. The 15th Field Ambulance took over forward medical posts from the 2/5th Ambulance: the 15th Brigade posts were now in the hilly country, and the 18th in the valleys. At the end of February the 2/5th Ambulance was admitting patients from the 15th Brigade in accordance with the general

administrative changes taking place throughout the division. The 15th Field Ambulance towards the end of February took over the A.D.S. at Guy's post, and the M.S.P. at the junction of the Faria and Mainstream Rivers. Many of the tracks were very bad, and at times impassable. The work of these two ambulances was divided in order to supply medical cover for two planned attacks; that of the 2/12th Battalion on Ward's village on 12th March, was allotted to the 2/5th Ambulance, and that on Saipa by the 57th/60th Battalion to the 15th. Rutherford with a detachment of the 2/5th Ambulance took over the running of the medical staging posts at Kesawai and Evapia River. No resistance was encountered in either Ward's village or Saipa, and the 57th/60th Battalion moved on to Yokopi. The 58th/59th Battalion moved north of the Kankiryo Saddle, and began to follow the course of the Kabenau to the coast. On the 18th Barum was occupied, and patrols made contact with American troops patrolling from Saidor.

The 15th Field Ambulance had established an A.D.S. at Saipa on 23rd March equipped with eighteen beds, a theatre and resuscitation ward, and at Yaula a new A.D.S. and theatre were planned. Most of the larger posts were by this time reduced to staging post level. Yet even at the beginning of April there was still need for some surgical care; Major Ryan and a surgical team were expected at Saipa, where five battle casualties were received on 1st April after the ordeal of a nine hours' journey. A rear R.A.P. of the 57th/60th Battalion was set up at Scott's Creek, and nursing orderlies were sent forward there to help. After a sharp encounter with the Japanese the 57th/60th Battalion occupied Yaula on 6th April, and found a quantity of useful stores. Pursuing the advance, the battalion occupied Bogadjim on 13th April. By this time the long and vigorous patrols had probed the country to the coast, and further concerted action from the enemy was prevented.[2]

The 11th Division now had control of all units in the Ramu Valley, as from 8th April, and Colonel N. D. Barton, its A.D.M.S., relieved Refshauge, who had been acting as A.D.M.S. to the 7th Division. The Scott's Creek post was receiving patients in its twelve beds by the middle of April: some of these suffered from typhus fever, for it was considered that unless such patients could be evacuated early, they were better to remain under local care. On the 17th Yaula opened twenty-five beds and A.D.S. Saipa became a staging post. The M.D.S. held less than 90 patients, and on the 19th ceased to admit more. On the 21st the 15th Field Ambulance was directed to concentrate in the Bogadjim area with the 15th Brigade.

ADVANCE UP THE COAST

Patrols of the 57th/60th Battalion of the 15th Brigade took the track from Bogadjim to Madang along the coast, but met the difficult obstacle of the Gogol River. Several attempts to cross this deep fast-flowing stream

[2] Australian casualties in the Markham and Ramu Valleys 18th Sept 43-8th April 44: killed in action 19 officers, 186 other ranks; wounded in action 29 officers, 435 other ranks.

failed; it was wide and flanked with mud flats and infested with crocodiles. Help of the American boats was enlisted, and the patrol was landed at Bili Bili to the north, and soon arrived at Madang. They routed a Japanese rearguard and occupied Madang on 24th April. The work of the 15th Ambulance in the inland area was by this time coming to a close. On 26th April its heavy gear was waiting at Dumpu airstrip, and two days later the unit moved on to Saidor.

By the 29th the A.D.S. Yaula was already evacuating patients to Bogadjim. The 2/5th Ambulance took over the ambulance staging post at Guy's and the M.S.P. at Kankiryo where there was a jeep post. This line of communication was practically closed by May, when there were only twenty-five patients in the M.D.S., and the total number was rapidly dwindling. On 15th May the last few patients were passing through Kankiryo; part of the ambulance unit left by air, and the remainder travelled by ship to Australia.

In the middle of April the 8th Brigade under command of 5th Division moved to Saidor, and on the 23rd, part of this brigade landed at Bogadjim in small coastal craft. On the following day after patrols of the 15th Brigade had entered Madang, battalions of the 8th Brigade joined them and occupied the area. Medical cover was provided by "A" Company of the 2/15th Field Ambulance. The occupation of Madang offered little military difficulty, but marked an important stage in these campaigns. The clearing of the Huon Peninsula, which had begun in September with the capture of Lae had been followed by the taking of Finschhafen and of the Markham and Ramu Valleys. Now the coastal harbours came under control, and the American force at Saidor made a long sea hop to Aitape and Hollandia, landing there successfully on 22nd April.

The 30th Battalion on 26th April went on to Alexishafen, and the following day a detachment of the 2/15th Field Ambulance reached Alexishafen and opened as soon as shelter could be improvised. Two days later there was considerable movement by medical units: the light section of the 111th C.C.S. left Saidor for Madang; the 15th Field Ambulance arrived at Saidor by air from Dumpu, to take over the 2/15th posts, and the 4th Field Ambulance went to Madang, and a few days later sent a detachment to Nadzab to set up a plane evacuating post.[3]

Meanwhile "A" Company of the 2/15th Ambulance had been able to cope easily with the evacuation arrangements. Most of the casualties had been taken direct to Finschhafen on H.M.A.S. *Vendetta* and H.M.A.S. *Bundaberg*. This unit was also responsible for a beach post, an airstrip post, and evacuation at Saidor, pending the arrival of the 15th Field Ambulance. Patients requiring treatment were handled by the 23rd American Field Hospital.

Fortunately there was little illness, but the A.D.M.S. regarded the early medical arrangements as sketchy. The G.O.C. had attempted to have a complete casualty clearing station sent up instead of a light section only,

[3] Australian casualties for Bogadjim to Madang and Alexishafen 8th-26th April: killed in action no officers, 5 other ranks; wounded in action 1 officer, 1 other rank.

but without success, for the heavy section of the 111th C.C.S. did not arrive at Madang till 28th May. The field ambulances were also hampered by delays in movement of their heavy equipment, and were deficient in tentage. One factor in keeping illness in the area at a low level was the early arrival of the 11th Malaria Control Unit and control work was quickly under way, in spite of difficulty in transport, for there were no useful roads in the area. On reaching the Madang area all troops were given twelve tablets of atebrin a week. The malarial rate among troops in the area steadily fell until a satisfactory figure of 0.9 per 1,000 per week was reached.

During the second week in May, the 15th Ambulance proceeded to Bogadjim, and some continued on to Madang. The 8th Brigade continued the advance, and on 16th June occupied Hansa Bay. The brigade was accompanied by a detachment of the 2/15th Ambulance, which incidentally, arrived at Hansa Bay before the infantry. An alarming number of cases of scrub typhus occurred during this advance, some forty to fifty were seen in this unit within a short time. These men were sent back to the M.D.S. at Alexishafen by the *AM 1567,* a journey of some six hours over an often choppy sea. At first the less severely ill were sent farther on to the C.C.S. at Madang, but although this only imposed an extra hour's travel over calm harbour waters, experience showed that the typhus patients did not tolerate any extra exertion well. To deal with this situation a request for nurses was made by the A.D.M.S., and a building of the old mission at Alexishafen was repaired and converted into wards. A physician, Lieut-Colonel K. B. Noad, and members of the A.A.N.S. were then sent up and attached to the M.D.S. where they were of great value. Later a C.C.S. was established at Madang, and still later the 2/11th A.G.H. was brought up into the area. Then, with the help of occasional evacuation by hospital ship and air transport the medical position was much improved.

CHAPTER 11

MEDICAL CONDITIONS DURING THE HUON AND RAMU CAMPAIGNS

FROM the outset the operations carried out in the Huon Peninsula differed in some respects from the previous experiences of the divisions concerned. The air-borne assault on Nadzab by the 7th Division opened a campaign through the Markham and Ramu Valleys to the coast which was largely concerned with air movements. The 9th Division, on the other hand, began with an amphibious operation, and early encountered the difficulties of beach landings and river crossings. Both divisions had to overcome the natural obstacles of difficult terrain, to decide how far forward it was wise to begin surgical treatment of casualties, and to arrange the regional details of transport of sick and wounded over a long and complicated evacuation route. Though the work of field ambulances was often widely different in its application from that of the Middle East, the principles remained similar, in particular the exploiting of the unit's ability to split off small sections which still retained the functional capacity of the parent unit.

EVACUATION OF SICK AND WOUNDED

The 7th Division. Problems of evacuation from the 7th Division in this campaign fall into several phases; that centred round Nadzab in the action on Lae, that connected with the advance up the Ramu Valley and the final drive from the Finisterre Range to the coast.

On the initial march from Tsili Tsili on Nadzab a detachment from the 2/5th Field Ambulance accompanied the force; a second detachment of an officer and ten O.Rs. was found necessary only for the first two days. Sick were sent back to rearward bases at first, and as soon as the immediate objectives were secured, forward to Nadzab. Casualties among paratroops were treated by the medical personnel of their regiment, and those occurring among the A.I.F. by the ambulance detachment.

Medical requirements for the attack on Lae were met by the M.D.S. staffed by the headquarters of the 2/4th Field Ambulance, and A.D.Ss. set up according to need on the evacuation lines. Forward from the A.D.S. a detachment of an officer and eight other ranks linked the dressing station and the aid post. In accordance with the policy adopted in the Wau-Salamaua campaign and later, a surgical team worked at the forward A.D.S. Within the division during and just after the action against Lae native carriers were used, but the value of employing wheeled transport for evacuation was clearly evident, and jeeps were used as soon as practicable. Fittings were used on the jeeps to carry three lying patients: this method was found useful except where the roads were too rough for sick men, and likely to cause delay and discomfort.

After Lae fell casualties from the independent company at Kaiapit were brought by air to Nadzab where most of the work of the 2/4th Ambulance was then being done until this unit handed over to the 111th C.C.S. at Nadzab and moved on to set up its M.D.S. at Kaiapit.

Behind the forward troops the distance between the M.D.S. and the airfield was reduced as far as possible. Usually a jeep could take patients to a plane loading post on the airfield, consisting of an officer and nine O.Rs., but several more men were needed to look after the sick, as the uncertainty of air movements, particularly over the ranges, often kept the patients waiting for considerable times. Early starts were necessary too, owing to the small number of vehicles available, and movement often began as early as 5 a.m. Further, a smooth organisation was needed at the airfield as the planes could not stay long on the ground.

The need for a holding unit was soon evident in the Ramu Valley. The wastage of men with a relatively slight or brief illness made it desirable to return to their units all who could safely be so returned within a short period. Therefore a rest camp or convalescent section of a medical unit saved the loss of men sent to the base. Where two field ambulances were sustaining the medical care of the division one inevitably had to discharge some of the functions of a C.C.S., a static role for which it cannot afford the staff. Unduly high figures were reached for admissions in the clearing station and the ambulance: occasionally the versatility and elasticity of the latter units were strained too far, especially when we consider that the provision of the necessary accommodation was also in part dependent on the efforts of the members of the unit.

The 2/6th Cavalry (Commando) Squadron's organisation for medical evacuation illustrated the opposite aspect, that it was not merely the question of transport of sick and wounded to a unit equipped more or less for acting as a hospital, but the prompt handling of casualties on cavalry lines, with a medical staff moving along the axis of advance. The plan followed with the wounded was to arrest bleeding, apply a dressing with sulphanilamide powder, give morphine, and then leave the man temporarily under cover until he could be brought within the squadron's perimeter or evacuated to another unit. First aid measures were simplified; for instance, "sucking" in chest wounds was controlled by elastoplast until suture was possible. Where a severely wounded man had perforce to be moved before further treatment could be undertaken, injection of morphine (½ grain) combined with hyoscine (1/100 grain) was found valuable. This not only relieved pain but produced an amnesic state which greatly lessened distress. On occasion, morphine for injection was supplied to leaders of small parties of men in very rough country.

Air transport solved the problem of medical disposal when opportunity offered, as at Kaiapit on 20th September, when anti-shock measures and urgent surgical intervention were possible before the patients were sent out of the area. Occasionally time and facilities were lacking and early intervention was impossible, as in the rare abdominal wounds. The Thomas splint was invaluable in a severe injury such as compound fracture of

the femur, and when it could not be carried its loss was felt, as even a short carry would cause a severe degree of shock when no efficient method of immobilisation was to hand. Resuscitation was then a much more difficult problem.

More patients had to be sent back because of malaria than any other single condition. From 22nd September to 8th March, 228 cases of confirmed malaria were evacuated, and in addition numbers of men with undetermined fever were either treated in the forward units or evacuated. Dysentery was not a serious cause of man-wastage, owing to the prompt use of sulphaguanidine. When necessary this was supplied to forward aid posts.

In the early stages of advance up the valley, some difficulty was experienced in crossing rivers until air transport solved the problem. Patients taken by jeep to Kaiapit were ferried in rubber boats across the Umi River after the brigade had crossed. Air transport provided a quick comfortable route to Nadzab, saving a long trip by jeep to Kaiapit, but of course other problems could arise, such as bad flying weather or heavy casualties. These conditions could necessitate holding patients *en route,* which in turn created a demand for more accommodation and for another surgical team.

Goulston was brought up to the Gusap strip with his light section, and there set up a holding post for sick and battle casualties until planes were available to fly them to Nadzab. This post evacuated 136 patients in five days with very scanty facilities. The headquarters of the 21st Brigade was then at Dumpu, and as there were some severely wounded men needing treatment, a team under Major J. Loewenthal was brought up to deal with them on the spot in an extemporised theatre. A few days later patients were arriving faster than shelter could be provided, and no tents were available, but twenty beds for admissions and thirty beds for a surgical ward were then in operation at Dumpu. So well did these extemporised measures meet the need that a centre equipped for urgent surgery was open and ready in the foothills. The 2/6th M.D.S. was by that time holding 245 patients, and went on to establish records for a field ambulance. The day after this expansion began, the headquarters of the unit was at Uria-Ramu junction, and its "A" and "B" companies arrived by air from Nadzab. As the brigade moved up the Ramu Valley a medical detachment moved with it. The 2/6th Ambulance was flown by plane loads to Gusap, and when an M.D.S. was established at Dumpu minor conditions were treated there, and men more seriously ill were, if practicable or desirable, flown back to Moresby.

During the operations in the foothills of the Finisterre Range to the north of the Ramu Valley, transport of casualties was accomplished by native carriers and members of the medical units, and this arrangement satisfactorily handled the number of casualties encountered. Jeep transport proved very useful, though slow and often rough, owing to the difficult country traversed. Certain other drawbacks were observed. Delays were often inevitable when the number of patients was considerable, as the

vehicles were controlled by the Army Service Corps which had important duties to discharge. It was similarly difficult at times to secure transport for urgent cases.

As on other fronts natives preferred to make their own stretchers, though one-man tents served the purpose in some areas. The Stokes litter was found useful, especially over difficult trails, and was used with some success forward to the Evapia River as a flying fox to cross the water. During heavy rain a bridge was washed away over the Faria River, but this difficulty was overcome by detailing a ferry party of one N.C.O. and eight O.Rs. to take patients across the river.

At the beginning of January actions began on the higher ground leading to the attacks on important features, such as Kankiryo Saddle and Shaggy Ridge. The extremely difficult terrain increased the time elapsing between wounding and arrival of the casualty at a medical post. For this reason, in order to reach the A.D.S. before nightfall it was necessary that wounded men should leave the forward R.A.P. shortly after midday. Where possible, native carriers were used, but unit bearers collected wounded from the forward areas and handed over to the native squads at the forward aid post. The task was made more difficult by the shortage of trained medical orderlies. During the fighting on the ridges through lack of sufficient stretcher bearers and native carriers, many casualties could not be brought in to the A.D.S. for two days after wounding. Neil Robertson stretchers were found most valuable in moving wounded down the cliff sides, though the type of stretcher available was rather heavy for convenience. On certain parts of the mountain trails the razor-back ridges were so steep and slippery that field ambulance members had to pull themselves up by ropes tied to trees. These ropes also proved very helpful in carrying stretchers down.

While the attack on the Kankiryo Saddle was in progress, the ambulance section had the task of rescuing wounded men from a rocky slope too steep even for native bearers. The stretchers were brought up by a chain of men passing from hand to hand. Surgical teams were attached to the A.D.S., and after treatment patients were taken by jeep to the M.D.S. at Dumpu.

Valuable experience was gained and lessons learnt concerning evacuation of casualties in difficult country: these were recorded by a conference of officers concerned. The most important recommendations may be summarised as follows:

1. The R.M.O. should always be acquainted with the situation and keep himself informed.
2. Field ambulance officers should get to know the country.
3. The R.A.P. should be as far forward as possible.
4. In moving aid posts and supplies help is most desirable.
5. The ideal time for the casualty to reach surgical aid is six to eight hours. As bearers cannot travel at night it is desirable that attacks should be timed early in the day.
6. It would be ideal to have some natives allotted to the medical services with an Angau representative, or a battalion native liaison officer to control natives at the battalion end.

The 9th Division. The experiences of the 9th Division were varied during campaigning in the Huon Peninsula, and much effort and ingenuity were called for in the three fields of medical evacuation, by sea, land and air. In his report on the work of the 9th Division medical services in the Lae and Finschhafen campaign, Colonel Hanson remarked that facility in what might be called jungle war-medicine could only come by individual experience. Instances have already been mentioned of difficulties which arose in units or services untried in battle conditions. Work on the beachheads had to be adjusted to the local conditions; a medical unit had to be set up quickly and consideration of the absence of native bearers and the small numbers of bearers in the ambulance units demanded that the carrying distance should be short. Surgical aid was needed in M.D.Ss. within the beachhead, and dressing stations with attached surgical teams should be ready to move forward as required. Field Ambulance detachments were provided to act in close relation to each battalion. This principle of sub-division was carried out with each ambulance company, which was split roughly in two, and small "main" dressing stations were formed, comprising one or two officers and thirty-five men. Three of these four sub-divisions were allotted to battalions and the remaining fourth was kept in reserve by the ambulance commander for various duties as occasion demanded.

It was fortunate that during the landing operations casualties were largely limited to those arising from an early bombing attack; as it was, the arrangements for evacuation were disturbed and delayed. During the second stage of the operation communications were limited, and the A.D.M.S., finding that an inspection of any area involved a day of strenuous travel, had to rely on the medical officers in forward areas to use that initiative which had been encouraged during their training. A small craft for carrying patients from the Burep River to Red Beach and back would have been most valuable; the paucity of such transport made this impossible, but these runs by sea soon became better organised, and casualties could be handled with reasonable expedition. Hanson recognised that the utmost energy and drive were required of A.D.S. commanders to get their patients back to an M.D.S. in an operable condition. The physical strain on stretcher bearers was in some instances extreme.

Evacuation from the beachhead was not at first satisfactory, partly due to the lack of coordinated method: the experiment of attempting to weld the different methods of the American Medical Company and the Australian Medical Corps had not been successful. After the closing of the American Medical Company the situation was eased by the arrival of another Australian unit, the headquarters of the 4th Field Ambulance, on 10th and 11th September, and a permanently staffed beach post was established. This unit had some ambulance cars which were helpful except when the local mud was too tenacious, when hand carriage was the only alternative and occupied many of the hours of darkness.

After the capture of Lae arrangements matured for the return of patients in empty cargo planes, and by the end of September these

transport methods were so far stabilised that it was not necessary to keep the 2/3rd C.C.S. in this area. In January the 106th C.C.S., then stationed in Lae, was very busy, and during the previous quarter would not have been able to carry on without help from orderlies detached from the 10th Field Ambulance and the 2/7th A.G.H. Its numbers at one point actually reached the high level of 1,100 patients, and for a time in November 963 beds were occupied out of a bed state of 1,000.

No hospital ship or carrier was available for the transport of casualties from Finschhafen, a distance of seventy miles, which took the small open landing craft some eight to ten hours. This remained a responsibility of the 9th Division. In Lae there were no facilities for the handling of casualties from Finschhafen unless air transport was promptly available, a situation that neither the divisional detachment in Lae nor the extra-divisional organisation there could handle without subjecting the patients to a double move. For some weeks it was necessary to break the patients' journey at G Beach near the Burep River, admitting them to M.D.Ss. until the next day, when they were re-embarked and taken round to Lae in time for a plane. In addition beach medical posts were working at Scarlet Beach, Red Beach and "7,000-point" beach Lae. When the heavy section of the 2/3rd C.C.S. arrived early in October, a detachment of the 10th Field Ambulance accompanied it, for sea ambulance transport duties. This unit was used for some time for similar purposes, with a most favourable effect on transport of sick and wounded.

The occurrence of hostile action at Scarlet Beach, when part of the staffs of the 2/8th and 2/11th Field Ambulances had to move patients to Simbang by sea was an instance of the drawbacks of having restricted transport. This journey was made on two landing craft, which were so heavily loaded that two empty craft passing them on the turn into Langemak Bay stopped their engines lest their wash should imperil the unwieldy boats.

When the Australian attack on Sattelberg and Wareo began, an M.D.S. was built at Heldsbach, and later a divisional rest centre was opened at Siki Cove. These provisions, and the use of returning native porters for the carriage of sick and wounded, helped smooth evacuation greatly, as short-term illness could then be treated without undue demands on transport. The arrival of the 2/2nd C.C.S. also helped in the difficult period ended by the fall of Wareo and the subsequent drive up the coast. The 2/3rd C.C.S. found the strain excessive when the daily intake reached 150. The absence of an administrative headquarters close at hand was felt at first, until the advanced headquarters of II Australian Corps arrived in Finschhafen, and took over the supervision of evacuation from the D.D.M.S., much to his relief. It was impossible for distant formations to solve problems of movement which could only properly be dealt with on the spot.

In June, hope had been raised that a sea ambulance transport of more suitable nature than the various forms of landing craft might be fitted out for this campaign. In early November *Stradbroke II* appeared, and later

in the month U.S.S. *Norab* arrived. *Stradbroke II* was originally a luxury yacht, and on conversion to a coastal hospital vessel could carry twenty-eight patients lying and thirty walking. Bunks were provided below, but these were not satisfactory, as stretcher racks of standard size would have given simpler and speedier loading. Patients were transferred from the vessel to D.U.K.Ws.,[1] which took three stretchers per vehicle to the shore where ambulance waggons waited. Walking patients were taken direct to an airstrip. Though there was inadequate protection from the weather D.U.K.Ws. proved very useful. One such combined trip could be made every forty-eight hours, and occupied nine hours.

Plane transport used Nadzab as an intermediate calling place at this time, but arrangements were made to go direct from Lae to Moresby or to Dobodura. The next step was to make Finschhafen the terminal for air transport. The Lae evacuation post was medically managed by Captain J. R. Sands with a detachment of the 10th Field Ambulance. For the months of October and November the total patients handled numbered 1,382 and 966 respectively; so that from the establishment of the post on 5th October, 2,348 patients were transported to base up to the end of November. Of these 22.8 per cent suffered battle casualties, 26.4 per cent had malaria and 9.9 per cent had P.U.O. There was in addition a residue which included an average of 23.6 per cent of sick who were not further differentiated up to that time.

The sea-air evacuation from the Finschhafen C.C.S. to the 2/11th Hospital at Dobodura occupied twenty to twenty-two hours, and required transfer of the patients successively to barge, sea-ambulance transport, D.U.K.W., ambulance waggon, plane and ambulance. Supervision by a medical officer was practically constant, and disturbance by loading and unloading was minimal. Loading the ship from the barges was quickly done, as the barges went out to meet the transport before it anchored. Similarly, at Dobodura the planes signalled by flag if they carried patients and were met by stretcher bearers and ambulances. Food, shelter and medical attention were available while the patients awaited a plane. During the flight from Lae to Dobodura patients were attended by an orderly of the American Air Evacuation Company, and an evacuation post formed on the airstrip by a detachment of an Australian field unit.

When the American hospital ship *Norab* arrived, runs were arranged to alternate with *Stradbroke II,* but schedules were not always maintained. *Stradbroke II* broke down, but *Norab* maintained the run till the middle of December, when air transport was in full swing from Dreger Harbour, Finschhafen. Though these two S.A.T. did not lift the number of patients at first expected, they gave valuable service at a time when a break-down in evacuation would have been serious owing to the lengthening line of communication. While *Norab* was operating as an S.A.T. an additional barge was available to the A.D.M.S. 9th Division, and air transportation was working smoothly, which was fortunate, as *Norab* was the only craft

[1] Amphibious powered vehicles: craft named after the official factory serial numbers.

taking patients from Finschhafen by sea. It was found that patients thus evacuated returned sooner than those sent by air to Moresby. Before these ships were available, most of the evacuation from Finschhafen was by small craft under command of the 9th Division. At first there were fears that exposure and discomfort might prove detrimental, but the sea was calm at this time, and sea-sickness was rare, and the condition of the men on arrival in Lae was better than expected. Hanson, however, pointed out that members of the 2/3rd C.C.S., realising that the hazards of uncertain evacuation arrangements might react severely on sick men, selected those for movement with great caution, even though this policy tended to overcrowd their own unit. It was hoped that detachments of the 10th Field Ambulance could care for men in transit on the small craft, but there was usually no space available for them, and enemy air attacks on Scarlet Beach interfered with normal work and gave full occupation to these detachments. A proportion of men arriving at the medical base at Lae showed signs of deterioration after certain unavoidable hardships of travel, but on the whole this was not an appreciable risk.

Some of the difficulties attendant upon disposal of the sick and wounded began in the early stages of planning. Movement and regrouping of armed forces were inevitable results of an advancing campaign, and evacuation measures were often complicated thereby, as the sick and wounded passed in succession through several administrative areas. Even discussions at a high level between Allies did not always resolve difficulties, owing to differences between services in military organisation, in methods and in standards. For example early planning for evacuation involving the use of sea ambulance transports revealed differences in opinion regarding the attendance practicable or desirable on these ships. Arrangements for medical attention on board, for medical supplies, and equipment and for provision of food all gave trouble. To obtain suitable sea-going craft was also far from easy, for the types of craft most suitable for this purpose were not always available.

In January 1944 the facilities for air transport of sick were expanded by the use of the airstrip at Dreger Harbour. The 10th Field Ambulance supplied a detachment to this air evacuation post, and late in January this unit had approximately 100 personnel at Lae, fifty at Dreger Harbour and forty-five at Launch Jetty. The tasks they performed were concerned with the evacuation of patients from the 106th C.C.S. at Lae to base areas and the handling of patients sent by air from the 2/2nd and 2/3rd C.C.Ss. In addition the ambulance carried out local improvements in the post at Dreger Harbour, and provided for the reception and disposal of patients who arrived by barge from forward areas, or were sent from the C.C.Ss. by barge to Dreger Harbour and thence to base by air.

Further trouble occurred when *Norab* could not proceed north from Dreger Harbour, and *Swan* instead made the connecting trip to transfer patients for Lae to *Norab*. Unfortunately *Swan* sank as the result of an explosion, and only one medical L.C.V. remained for regular transport from Launch Jetty to Dreger.

At the end of December a decision had been made to expand the 2/2nd C.C.S. up to a capacity of 600 beds. In order to facilitate this the 2/3rd was instructed to cease admitting, and to detach to the 2/2nd a medical officer and thirty O.Rs. The 2/11th Field Ambulance began to prepare a rest camp at Scarlet Beach to hold 500 convalescents for periods usually not longer than fourteen days. This enabled the 2/8th Ambulance, which had been holding some 130 patients at Masaweng, to empty with a view to moving on 3rd January. The 2/3rd Ambulance which was situated at Bonga on the evacuation line of the 24th Brigade, meanwhile was holding 150 patients.

As the pursuit of the Japanese accelerated up the coast the first medical task was the prompt establishment of evacuation posts on the beaches as beachheads were captured. This was at first carried out by the A.D.S. supporting the reserve battalion of the forward brigade, but later the freeing of the 2/3rd Ambulance from Wareo enabled an A.D.S. to do this work.

The advance to Sio offered no special problems: the divisional front was relatively narrow, and the flanks well protected, and casualties were collected without difficulty. As the line stretched out, the journeys made by small craft became longer, but the advent of bad weather made the trip rough and occasionally dangerous. This made it necessary to increase the holding capacity of the forward medical units. Fortunately, the incidence of pyrexias declined, and the changing monsoon gave a following northerly wind which permitted evacuation to Finschhafen. By using three ketches fifty to seventy patients could be transported without hazards of fuel or weather against a head wind. The obstacles of bad weather did not prove as formidable as expected, and evacuation proceeded satisfactorily.

The 5th Division. The work of the medical services in the 5th Division from March 1944 onwards introduced a new phase in evacuation of the sick and wounded, since it was largely dependent on sea transport by barge. Airstrips were not available beyond Saidor and land transport was restricted by the local geographical conditions. In the sector from Saidor to the mouth of the Ramu River jeep traffic was only possible over limited stretches, as the coastal track was constantly intersected by streams. Fortunately most of the beaches were suitable for barges, though patches of jungle often grew to the edge of the water, and jetties were dotted only occasionally round the coast. The demands of operations in other parts of the S.W.P.A. limited the amount of sea transport which could be spared, but, although this amount was not sufficient for the movement of men on any but a limited scale, an adequate and reasonably comfortable line of sea communications was maintained.

NUTRITION

The whole question of rations and nutrition was given serious attention during the Huon Peninsula campaigns. Package and distribution were, of course, of great importance, and the latter in particular was fraught

with many difficulties. These difficulties varied in type and intensity at different periods of the campaign, and the actual ration itself was directly related to distribution, as mobile troops required food from a pack containing the balanced day-by-day requirements of a small number of men or even one man. The "operational ration" was devised to meet this need. Early in December Lieutenant H. E. Young, who was a field research officer in nutrition at the Australian Headquarters, examined these problems in the area of the 9th Division. The use of tanks at this time made it necessary to maintain a jeep track for supplies; therefore this set-up did not represent the typical picture, but rather the more complex one of jungle warfare with difficult lines of communication not always covered by special carrier teams.

The opinion of the medical services was that mobile troops did not receive sufficient vitamin *B* complex with their rations until the operational ration came into use. Some of the larger packs used in the ordinary scale were wasteful, and opportunities for the use of some components such as margarine and wheatmeal were not always available. "Marmite" or substitute often could not be obtained. Young in a nutritional survey of the 9th Division estimated the ascorbic acid content of samples of the ration obtained from cookhouses and A.A.S.C. stores. No major variations from normal values were found, and the amount of this vitamin available in the canned goods examined was within normal range. Fresh foods were not obtainable there at that time.

The powdered and condensed milk supplied were found of good quality, and tea and sugar were of ample quantity, though there was considerable wastage of tea packed in thin wooden boxes permeable to moisture. Blue boiler peas, designed to furnish vitamins, were not successful and often arrived mouldy or fermenting. Margarine was satisfactory in quantity and flavour, but the "tropical spread" was hated by most men. In several of these types of tinned foods there was undue wastage owing to the large size of the containers. A cold store at Finschhafen made it possible to supply fresh butter to troops in the vicinity, with whom it was very popular. Field bakeries did good work in localities where they could be established, as at Finschhafen, but carriage in sacks to more distant areas was not successful. Biscuits were plentiful, but were disliked by the men and by many dental officers also.

The staple food of the division was bully beef, but the large size of the case, 53 pounds, required two men for its carriage, and therefore cases were broken so that a single load did not exceed 26 pounds, which could be carried by one man. The meat and vegetable ration was not liked: as a breakfast dish it was particularly monotonous, especially when served cold to mobile troops. Fresh meat was most popular, but it could not be transported far in that climate without deterioration: this reduced the ration to 4 ounces. Ham and bacon were sometimes available, they kept well and were greatly liked. Tinned herrings still evoked the dislike of the men, and the poor quality of Australian salmon did not arouse popular esteem. The troops grew tired of fruit juices, but in fact these were of

very good quality and were appreciated. The forward operational ration was most useful for troops like commando squadrons, though after the third day of use the predominant sweetness of this ration made the men tire of it. "Canned heat" on a scale of one can to two men per day was very valuable, and provided each man with three cups of tea a day: an increase would have been appreciated. It is interesting that ascorbic acid tablets, which were in fairly adequate supply, were asked for by the men, though to pack them in 100-tablet bottles was wasteful, as the tablets became moist. Fortified chocolate was most successful, and was regarded as a "morale builder". Wheat germ was supplied to provide vitamin *B* complex, but it was only with certain foods like wheatmeal that the men were willing to eat it. In general, Young found that deficiencies were due more to unsuitable size and design of packages than to difficulties of transport.

A similar survey of the 7th Division showed the general position in December 1943 to be much the same as in the 9th Division. Tinned vegetables were satisfactory, with the exception of cabbage, which few of the men would eat. Blue boiler peas were more edible than in some other areas; troops themselves showed enterprise in sprouting the peas, and ate them raw. The bread position was very satisfactory with two brigade bakeries staffed by personnel of the Catering Corps. Bread rolls were issued in the more forward units and were much appreciated. Wheatmeal was liked by most of the men when facilities for cooking were at hand. Ascorbic acid was often in short supply with the 7th Division, and for a time, until the lack was remedied by a member of the Catering Corps, salt was also not fully supplied. The forward operational ration was found to be very good, and throughout the 7th Division its liberal supply produced economical use of the regular standard ration, avoided monotony, and prevented wastage. It was realised by the catering nutritional advisory staffs that a certain amount of education was needed in order to ensure correct use of the operational ration. New formations entering an area were often not well informed on this subject. Fresh food was not easily obtained, but the arrival of an occasional plane load from Mount Hagen and small local purchases showed how it was appreciated. In the commando units a greater independence was necessary. The 2/6th Cavalry Commando Squadron baked its own rolls, and the men sprouted blue peas in tins or dixies while on the move.

It was found that 38 to 39 ounces per man constituted the minimum amount of daily ration which would prevent loss of weight. One unit used a ration of 32 ounces over short periods; but over a longer period nutritional disturbances could be expected. The "Q" Branch of New Guinea Force advised that the field operational ration, containing 3,750 Calories and fortified with vitamins, should be used in all operations where troops were engaged from other than base areas, and in all forward areas until the combined ration scale could be applied. It was further recommended that vital foodstuffs should be sent to forward areas in small containers till satisfactory distribution could be assured.

The field operational ration was particularly useful for patrols, but only one or two days' supply could be easily carried. Making up insufficiencies with the emergency ration was not regarded as desirable, but on occasion it was difficult to suggest another course, as the troops could not live off the country. However, long patrols of six days or more were usually exploratory in nature and native carriers could be taken.

Deficiency disorders. After previous campaigns cases of avitaminosis were reported, though these were not of serious type or degree. The vitamins deficient were ascorbic acid and the *B* complex. Loss of weight, muscular weakness, disturbances of sensation, oedema of extremities, and lesions of the mouth, lips and tongue were the most commonly seen signs and symptoms. These were observed after the rigorous conditions of the Owen Stanley Range, in the Wau-Salamaua sector, and after or during the Ramu Valley and Finschhafen operations. Early in 1943 the Director of Medicine wrote to the D.G.M.S. stating that there had been definite evidence of nutritional deficiency among troops in forward areas in New Guinea, and that the signs of *B* deficiency indicated that the amount in the diet of most troops was too small. He considered that, although there was a sufficient supply of ascorbic acid tablets for forward troops, the proper use of available foods would be better. He recommended fortification of bread in field bakeries and supply of dehydrated butter as helpful in attaining a balanced ration.

During the Huon and Ramu campaigns there were occasional clinical evidences of deficiencies noted in previous campaigns. Royle of the 2/10th Battalion and McDonald of the 2/12th Battalion noted that a considerable number of men were sent to the R.M.O. by platoon commanders as unable to cope with infantry training. Some of these were apathetic, and had no appetite, and examination showed some tenderness of the shins and analgesia of the leg muscles. A few had oedema, and in addition conjunctivitis and bleeding or ulceration of the gums. Not all these findings could be necessarily attributed to avitaminosis, but in view of the dietetic conditions prevailing in areas where it was hard to supply fresh foods, it seemed likely that there was at least some deficiency of the *B* complex. Intramuscular administration of vitamin *B1,* the only supplement then and there available, was followed by clinical improvement, which was not observed in a control group receiving distilled water only.

Ford and other observers at Moresby had at an earlier date seen several undoubted cases of vitamin *B1* deficiency. In October 1943 Major N. M. Gutteridge, medical liaison officer with "Q" Branch (Nutrition), reported to the D.G.M.S. on the European ration in New Guinea. He pointed out that there was a deficiency of vitamin *C* in the rations of the troops, and that distribution difficulties had not been entirely overcome at that date. Air-dropping had improved the position, but shipping space was sometimes wasted by the canteen services in sending bulky breakfast foods and cordials which were deficient in vitamins. Emphasis was also placed on the "morale value" of certain items such as fresh foods, and fortified chocolate.

The Huon Peninsula campaigns viewed in retrospect show that considerable headway had been made in the nutritional side of the care of troops committed to action in this rough country with its obstacles of climate and terrain. Officers and men were attaining more experience, and were rather better educated in the scientific and practical side of the problems of rationing in the field, and distribution was better carried out. Having in mind the coincident wastage of troops by endemic disease the position was improving, but further advances were needed so that all effort might be applied where most needed.

MOSQUITO-BORNE DISEASES

The disease of prime importance was of course malaria, not only by reason of its disappointingly high incidence in the 7th and 9th Divisions, but because of its inroad into manpower.

Dengue fever was of much less serious import, and the force of individual attacks was soon spent, but its appearance in epidemic form dealt a swift blow at the formations it attacked. Its vector had also the inconvenient habit of biting in the day-time.

Epidemics occurred in Lae, Finschhafen and the Ramu Valley during the operations of 1943. The 9th Division in the coastal sector was heavily attacked. In December 828 cases were notified, and the A.D.M.S. in quoting 8,813 as the total incidence of the divisions, pointed out that men diagnosed as P.U.O. were excluded from the count, which was probably underestimated. The clinical features of the sandfly-dengue fever group of diseases are usually distinctive, but in the early febrile stage if no rash appears the diagnosis from malaria may be in doubt until a reliable blood examination has been made. The rather characteristic variation of the clinical picture from epidemic to epidemic may also cause temporary confusion. However, there was no doubt that a considerable outbreak of dengue fever occurred in both the 7th and 9th Divisions in the latter part of 1943 and early 1944. This alone showed that personal and group precautions against mosquitoes were not being observed effectively, though the more domestic habits of the *Aedes* required preventive measures rather different from those needed for anophelines. There was no certainty in 1943 that the *Aedes aegypti* was the only vector concerned, and experiments were carried out with a view of producing the disease from the bites of mosquitoes allowed to feed on patients with dengue. This research produced no results on this occasion, but early in 1944 further experiments were successful. This work culminated in the establishment of *Aedes scutellaris* as an effective vector of dengue.

Breeding was found mostly in shaded areas, and was commonest in rain water in discarded tins and drums or other containers, also in natural locations such as coconut shells and axils of trees. Some points of interest and importance arose in the epidemiology of dengue in the north-eastern part of New Guinea. Hanson drew attention to the difficulties of precise differential diagnosis, which were probably increased by the occurrence of sub-clinical attacks; but there was no doubt of the nature

of the epidemic even in the midst of a considerable incidence of malaria. The origin of this outbreak of dengue was less clear. It seemed likely that there was an infected reservoir of mosquitoes in Lae before it was occupied by Australian troops, but in some other areas, such as the beaches east of Lae, mosquitoes were numerous, but probably uninfected, since dengue was not clinically apparent. Cases occurred, however, within a week of the troops entering Lae, and a few probable cases were observed in units housing men who had been in Lae. Tami Island also proved to be an infected area: there were swarms of mosquitoes, and it had just been vacated by Japanese troops. New reinforcements also contracted the disease. From this data it would appear that the Japanese were the human carriers of the disease in these areas.

The position was not so clear in other areas such as Finschhafen, and in particular Heldsbach, where the first troops living there contracted a fever which appeared to be dengue. Owing to the lack of technical facilities there was some doubt at the time whether some of these fevers were malarial. It is possible that here too the disease was contracted from Japanese carriers infected before the Australians arrived in the locality. Preventive measures against the adult mosquitoes were thought to be insufficient by the D.A.D.H. of II Corps, Major T. M. Clouston. There is no doubt of the importance of natural or semi-natural foci of breeding such as untended coconut groves, and rock pools along the coast, but in addition, defections from hygiene enhanced the risk to troops in these areas, and, in greater degree, to troops entering at a later date. Personal protection against day-biting mosquitoes was difficult to establish and to enforce, but measures adopted against the adult insects were important. In the 9th Division no attempt was made at first to keep dengue patients under nets, because of the discomfort from heat, but later, nets were used till the end of the third day. To reduce the risk of infection among nursing orderlies alone was thought worthwhile.

The A.D.M.S. concluded that the Japanese were already infected, and that coastal areas would probably be infective to non-immune troops. The 20th and 26th Brigades were probably immune for some six months after their considerable exposure, nevertheless fuller precautions against day-biting mosquitoes were advisable.

In view of this epidemic in New Guinea the occurrence of an epidemic of dengue in Northern Australia in 1941 to 1942 was of interest. A conference was held in Brisbane on 29th and 30th May 1943 on the position with regard to dengue and malaria in Australia. Fairley pointed out that the disease was endemic in Darwin, but not in Queensland. In Townsville a sporadic outbreak spread widely among the Services and the civil population at the end of 1941. Moresby had been involved in an outbreak of dengue in the previous year, and its population, presumably partly immune, was not again troubled with dengue fever till early in 1942.

It would seem, looking back with knowledge of subsequent outbreak in New Guinea, that manifestations in Australia, both epidemic and sporadic were not necessarily directly related in causation, but were part

of the characteristic behaviour of the disease. Dengue fever as it occurred in both Australia and New Guinea, gave point to the value of epidemiological study, of biological research, of entomological investigation, and of practical application of the basic and specific measures of prevention. It was important not to regard dengue merely as a nuisance, but as a lesson in preventive medicine, and therefore the Allied Malaria Control Conference of New Guinea Force, formed in February 1943, devoted a meeting to a discussion of dengue fever in January 1944, when the inroads of the infection were evident. Ford drew attention to the severe epidemics which had affected troops on the north coast of New Guinea, especially in Morobe, Lae, Finschhafen and the Markham and Ramu Valleys. A large body of non-immunes entering an infected area such as these would be attacked by a rapid spread which would decrease the efficiency of men in contact with the enemy, both during the febrile and later depressive phases. Lae and Finschhafen in particular illustrated the importance of the possession of a malaria-free and dengue-free base.

Malaria. In both the 7th and 9th Divisions the incidence of malaria was considerably higher than had been expected. The epidemiological picture of the outbreak in these formations was that of a malarial epidemic; its magnitude and its possible implications had given rise to great uneasiness during the latter part of 1943, and by December was causing positive alarm. The Allied Conference on malaria control which met regularly in Moresby, had a meeting on 1st December on the topic of epidemic malaria at which Ford, the senior malariologist of New Guinea Force, gave an address. In this aptly timed account he pointed out how inadequate were many current ideas and views on the great difference between the sporadic and the epidemic inroads of malaria. Earlier in the year susceptibles had been more or less scattered, and only recently had large bodies of non-immunes been collected in the worst malarial areas. Here were the two requisites for an epidemic; a large reservoir of infection, augmented by that arising in the troops themselves, and a plentiful and efficient mosquito vector.

Ford further emphasised that on first inspection of some areas no anophelines might be seen, but it did not follow that this meant safety. On the contrary, the mosquito population would soon be built up in places where all the conditions favoured profuse breeding, and the apparently safe area became an acute menace. The importation of gametocytes in human carriers even into an uninhabited area could bring risk; therefore personal protection should be adopted from the beginning. The ability of the vector to adapt its habits to artificial breeding places like vehicle tracks, and cleared swamps, was a special danger, for, in Ford's words malaria "is a camp follower". The swiftness of the epidemic cycle was not always realised. At the end of the first week after the laying of eggs, adults were hatched, only two weeks more were needed for transmission to occur, at the end of the fifth week the first cases were seen, and after another week gametocytes were forming a human pool. Within two months at the beginning of this cycle infected persons could act as trans-

mitters, and the position became really serious. All this was well-known by the instructed, but it was not easy to translate this knowledge into action, such as personal protection, suppressive medication, destruction of adult mosquitoes and the use of plasmoquine as a gametocide, wherein its value lay.

At 7th January the malaria rates per 1,000 per week were as follows in non-operational areas: Moresby 4.7, Milne Bay 5.3, Buna-Oro Bay 3.7, Morobe-Lae 7.0, Bulldog-Wau-Bulolo 8.0. In operational areas the figures were: Finschhafen 31.1, Ramu Valley 29.1. The rate for the whole of New Guinea was 11.5. Special study of local conditions was often needed to interpret figures. For example in the Ramu Valley some breeding places differed from those seen elsewhere in New Guinea. At Dumpu, 1,000 feet above sea level, Captain D. O. Atherton found larvae breeding in quiet water in gravel beds and shallow channels. *A. punctulatus* flourished here, but was difficult to control by larval destruction; only measures directed against adults were successful, such as sprays and freon bombs. Ideally such areas were best avoided, but this was not always possible.

Fairley reported to the D.G.M.S. on the malarial position on 25th November 1943, stating that it was already serious in the 9th Division in the Huon Peninsula, and grave in the 7th Division operating in the highly malarious Markham and Ramu Valleys. The malarial rate per thousand per week was then 17.2, or expressed differently, 890 per 1,000 per annum. Total malarial casualties for the period 4th September to 26th November 1943 are well shown when expressed as a percentage of sickness casualties and of all casualties including wounds, in both divisions.

Among the forward troops of the 7th Division malarial casualties made up 90 per cent of all the casualties due to sickness, and no less than 83 per cent of all casualties, including battle casualties, were malarial in origin. The corresponding figures for the forward troops of the 9th Division were 60 per cent and 44 per cent. Fairley pointed out that these figures suggest a comparison with the incidence experienced in Milne Bay, but the effect on the force was not nearly so severe in the present instance because of the better general conditions prevailing in the Huon Peninsula campaigns. Control work was less promptly applied in the 7th Division, as the malaria control unit was not brought up for several weeks; the 9th Division had the use of control units at an earlier date. Front-line troops in the 7th Division attained a malarial incidence of 85 per 1,000 per week in the middle of October, and corresponding troops in the 9th Division showed the much lower figure of 34 per 1,000 per week.

Atebrin was plentiful, but, though there was no awkward period of transition from quinine as in Milne Bay, it was not taken regularly by many, as enquiry showed among patients in medical units. An occasional cause of delay in the distribution of atebrin to troops was the temporary loss of a package of the drug which arrived perhaps at night, and went astray among other supplies. When the divisional supply arrived, as it did at times, in relatively small packets, this could easily happen. In the week

preceding Fairley's report when ten weeks had elapsed since the beginning of operations (the classic period required for the building up of an epidemic) the total rate for the 7th Division rose to 93 per 1,000 per week, or 4,840 per 1,000 per annum. The total rate for 30,000 operational troops was 55.3 per 1,000 per week for this period, which coincided with the heavy fighting under difficult conditions which has been described earlier.

By this date it could be authoritatively stated that 0.6 to 0.7 gramme atebrin a week was an effective suppressive dose, as this had been scientifically proved by experiments on volunteers in the Land Headquarters Malaria Research Unit in Cairns. Notwithstanding these experimental findings, the situation was such that it was imperative to ensure that ample concentrations of the suppressive drug was maintained in the body circulation. Therefore the suppressive dose of atebrin for Australian troops in the Ramu Valley was raised to 1.2 grammes per week by order of the Allied Supreme Commander. The average rate per 1,000 per week for December was 43.7, and by January this dropped to 14.3, for the troops of the 7th Division were then in process of being relieved. This improvement was not immediately or solely due to increases in suppressive doses, as was seen when the 15th Brigade, already experienced in anti-malarial precautions in the Wau-Salamaua sector, was brought into the area early in January. Fairley's report also stressed the importance of all the preventive measures, including protective clothing, the correct use of nets, the faithful application of mosquito repellent lotion, the use of pyrethrum bombs in slit trenches and shelters, and the unremitting use of atebrin. There was no doubt that the regular application of repellent lotion was hard to inculcate. Hanson thought that the forgetfulness of fatigue was responsible for more omissions than carelessness. There were no diversions for the troops after dark to keep them awake, and in dawn or pre-dawn reveilles repellent lotion does not seem to have been used. In Lae an attempt was made to waken men at three-hourly intervals for the application of lotion, since they had no nets. As might have been expected it was unsuccessful.

Nets have been mentioned more than once: the A.D.M.S. stated that they were not carried, not used, or used only as a body covering on cold nights. An attempt was made to collect nets with the purpose of re-issuing them when practicable. Experience showed that enterprises like night landings caused some difficulties in the use of nets. A brigade commander found that after crossing the Busu River only half the brigade still possessed nets. Nets may not be much heavier wet than dry, but as Hanson remarked, "that extra two pounds of water must feel like the load of Atlas". Everything carried by the soldier should be as light as possible. Questioning of fifty men engaged in the action against Lae showed that only 10 per cent of them used nets for the whole period in the battle area. In some base areas, such as Moresby, dress regulations were relaxed by recent consolidated orders, but the medical opinion, including that of the Combined Advisory Committee in Tropical Medicine, Hygiene and Sanitation was

opposed to this. It was thought wise to prohibit shorts in all malarious areas, including Moresby.

Enquiry showed that many faults could have been remedied by greater awareness of the position and prompter action. Dengue was late of recognition in some areas; meanwhile no action was taken against day-biting mosquitoes. Nets were discarded, usually on the soldiers' own initiative; dress discipline was good in some formations, lax in others; atebrin discipline was not always good, and mosquito destruction was not always directed against adults as well as against larvae in infected areas. Because larval destruction was a special duty carried out by malarial control units, officers and men alike were prone to neglect the simple use of a spray to kill the adult insects.

Garbage destruction was often neglected, and until the ready cooperation of American colleagues was obtained, dumping of unconsumed food in base sub-areas by Allied troops and the Fifth American Air Force was for a time a nuisance and a certain risk. In all such matters constant vigilance was necessary. Indiscriminate dumping of empty tins gave unwelcome opportunity for breeding of the mosquito vectors of dengue in infected areas, but all infractions of the rules of hygiene were bad as they made the men constantly careless of other preventive measures.

The question of battle strain in relation to malaria has been raised. The medical officer of the 2/6th Cavalry (Commando) Squadron formed some conclusions on this point. Malaria was far the commonest reason for evacuation. Between 22nd September 1943 and 8th March 1944 there were 228 confirmed cases of malaria in the unit, not including men with unconfirmed fevers treated in the lines. The incidence of malaria was found to depend on the area of operations, the degree of mental and physical strain associated with an action, the fitness of the men, a condition partly dependent upon rations, and the standard of anti-malarial discipline. Severe strain seemed to predispose to malarial break-down with a declared attack, but it must be remembered that periods of strain are conducive to neglect of precautions. Where more than one cause was present the number of cases increased, for example in the Kesawai area which was a centre of active operations, and was surrounded by several old native villages. The favourable effect of firm disciplinary measures of personal prevention was clearly evident as the campaign went on.

During the last part of September and the beginning of October the unit was strenuously engaged, rations were poor, and the native villages in the area were heavily infected, the average spleen rate being 70 per cent for the area. Few personal protective measures could be observed, and by the beginning of October the results were manifest, as malaria appeared in the unit. The numbers evacuated fell when the men were able to have a brief rest, but a move to Kesawai produced a further rise. For the first quarter of 1944 the squadron was withdrawn to a comparatively safe area where conditions were good and there were few mosquitoes: with good discipline malaria dropped to one per week. It was thought that only a certain percentage of cases were primary, as a large

proportion of a draft of fifty-one reinforcements developed malaria within a few days of arrival. Infection had evidently occurred between the Canungra jungle school and Dumpu.

As the 7th Division pressed on from Nadzab with its inland mission, progress figures showed that the devastations of malaria were more serious than had been expected. That over 1,000 primary cases of malaria should occur in such an experienced formation in some two months was chastening, for there were actually good reasons why the incidence should be consistently falling. All measures for group and individual protection were available, but that these advantages were not made operative to full extent was obvious. An official report on this part of the New Guinea campaign stated that "there is still some laxity of personal anti-malaria precautions": this was an under-statement. There was undoubted carelessness in applying precautions, for in spite of educational measures the men assumed that no mosquitoes were in a neighbourhood if the only evidence of their presence was an attack of malaria.

The efficiency of preventive measures depended on the degree of constancy with which the suppressive was taken and other methods applied as shown by experiences in the field. Malariologists, Ford, English and Fenner, had been appointed to the higher formations in the field to coordinate the preventive measures, in particular the work of the malaria control units, and entomologists were appointed to work in mobile units under Lieut-Colonel Mackerras. The pathology and hygiene organisation under Colonel E. V. Keogh was sound and active but the malarial battle could not be won by the technical staffs and advisers only. The Allied Malaria Control Conference in Moresby, drew together Allied medical officers and others engaged in prophylactic scientific work, and disseminated useful and accurate knowledge.

With its headquarters in Brisbane under the chairmanship of Fairley, the Combined Advisory Committee was the technical adviser to General MacArthur, and drew on the medical resources of all Allied medical services. All important medical directives issued by MacArthur were based on recommendations of this body. Yet in spite of these advantages of organisation and of application of close study and scientific research, the malarial losses were formidable. The basis for preventive measures was sound and firm, but more drive was needed to ensure that the soldiers themselves from highest ranks down carried out the necessary measures. The centre and energiser of the campaign against malaria in the Australian forces was Fairley. His great ability and experience and equally great drive and personal influence were chiefly used to control and direct increasingly better methods of diagnosis, treatment and prophylaxis of the disease which could lay waste an army and render the best military planning of no effect.

The period of September 1943 to March 1944 was well covered in a report on malaria in coastal operations in the Huon Gulf and Huon Peninsula by Fenner. This dealt with the history of the troops concerned, their standard of control and the results.

The terrain was highly malarious; the military operations were highly successful. This campaign began with better prospects than others previously fought. Equipment was better, protective clothing was worn, mosquito repellent and atebrin were available, and mosquito control was applied at an early stage in the operations, the control units moving with the troops. Notwithstanding all this nearly 10,000 men were evacuated with malaria.

Some of the troops concerned had little previous malarial experience, the 9th Division had been in Syria as occupation troops only; the 4th Brigade had been for several months in Milne Bay under the 5th Division, whose control was good; the 8th Brigade Group had no previous relevant experience. The troops were staged at Milne Bay and Buna; discipline at Buna was only fair. There was no question that the malarial risk was high in Lae and Finschhafen; the Japanese suffered heavily, 308 died out of 708 admitted to one of their field hospitals in the Huon Gulf area. An estimate was made of the malarial risk in the areas in which Australian troops were engaged at the time of the operations. This showed that the risk varied from very low to very high, but it was high in most of the important areas, and a low apparent risk was no earnest that military occupation might not increase it dangerously. Conditions were favourable for survival of adult mosquitoes long enough to enhance the risk of a rising infection rate. It was most important to realise that low anti-malarial discipline increased the risk of a gametocyte reservoir among the Allied troops. In Lae and Finschhafen adult control was ineffective; in Lae gametocyte carriers were promptly segregated, with the result that larval control was rapid and effective, whereas in Finschhafen this segregation was ineffective and larval control was consequently slowed.

The malarial risk was high during the first month after the landing, and it was only after this that control reduced the risk. Fenner made an analysis of the capture of Lae, the capture of Finschhafen and the enemy counter-attack, with the following offensives on Sattelberg and Wareo, and the final capture of Gusika-Wareo line.

Though allowances must be made for the different nature and intensity of these actions, the sick wastage figures as given in Fenner's report are most significant, as will be seen from the accompanying table:

Date and place	4th-17th Sept 1943 Lae	22nd Sept-10th Dec Finschhafen	3rd Dec-1st Mar Gusika to Saidor
Killed and missing	150	291	83
Wounded	397	1,037	186
Malaria	62	3,400	4,300

The troops chiefly concerned were as follows: Lae: 20th Brigade, 26th Brigade, divisional troops 9th Division, 24th Brigade, 4th Brigade; Finschhafen: 20th, 24th, 26th and 4th Brigades; Coastal campaign: Bonga to

Fortification Point, 4th and 20th Brigades; Fortification Point to Sio, 20th and 26th Brigades; Sio to Saidor, 8th Brigade. The number of cases of malaria occurring as an immediate result of the capture of Lae was 1,612, those from the Finschhafen campaign were 3,597, and as a result of the coastal operations 2,927.

This analysis pointed out that, though malarial wastage had been used as an index of fighting efficiency of troops engaged in the tropics, this factor is only one and too much importance can be ascribed to it. It was right that due attention should also be paid to the length of service in New Guinea, the physical condition of the troops on arrival there, the severity of the fighting, and the provision of reinforcements. The quality of rations and the efficiency of arrangements for medical care and convalescence were also important. Certain of these factors were well illustrated in the records of the 9th Division and the 4th Brigade. This brigade was much longer in New Guinea before the active operations than the division, five months as against one month, and had no reinforcements, whereas 3,400 reinforcements reached the 9th Division. The percentages of malarial wastage were comparable, 44 per cent of the division including reinforcements, and 43 per cent of the brigade, but the brigades of the 9th Division were still an efficient force some weeks after the end of active fighting, whereas the 4th Brigade had its battalions reduced from a strength of 1,658 to 952, many of whom showed a deterioration in physical condition. A more striking example had been seen in the Buna-Sanananda campaign, after which the troops engaged showed very definite reduction in physical vigour and capacity, and needed rehabilitation. The actual wastage was not so high in troops committed to driving the Japanese out of the Huon Peninsula as it was after the battles in the Buna area. The supply position of food, anti-malarial stores, in particular atebrin and nets, was more satisfactory and reliable in the 1943-44 campaigns; mosquito control was better organised and carried out.

Mosquito control warrants some further notice. Control by units was not very satisfactory during active operations. Hand sprayers suffered a high wastage rate, and the troops were not familiar with the use of freon dispensers, except in medical units, most of which achieved reasonable destruction of adult mosquitoes. Larval destruction was also poorly carried out by units until operations were over; this was hindered by loss or damage of knapsack sprayers.

Malaria control units were available early in the landings, and did useful work in adult destruction except in areas where protective blackout was enforced. Larval destruction produced prompt good results in Lae; in Finschhafen the tardiness of arrival of a second control unit hampered the work, as did also shortage of labour. Along the coast more prompt action was possible and the malarial risk at Masaweng, Sialum and Kelanoa was thereby lowered. Segregation of the gametocyte reservoir could be only partially achieved where native porters were used during operations, and where development of bases brought increased numbers of natives into these areas. In Lae, the 5th Division lost no time in

settling the native population away from the planned base. In Finschhafen, there were difficulties in removing a considerable number of natives. In medical units too many patients had to be treated without nets, which were seldom sent with the soldiers from their units. Narrowness of the standard ambulance stretchers and the native-built beds prevented proper rigging of the nets; the only effective solution to this difficulty was a wider stretcher. In some areas there must have been considerable numbers of gametocyte carriers; their reduction could have been achieved by better standards of anti-malarial control.

Recapitulating the position observed with regard to disciplinary factors, it must be admitted that the general standard was low, because it was not thoroughly enforced. Elementary dress regulations were not widely observed, and bad examples were set by some who should have known better. Repellent lotion was used, but in haphazard fashion, and its application by troops on duty after dark and at dawn was not controlled. Atebrin administration was not closely enforced, and the omission of occasional doses soon allowed blood concentrations to drop below safe levels.

Much has been said about nets already but five faults stood out as significant: (1) neglect of officers to ensure that men carried their nets, (2) failure to replace unserviceable nets, (3) lack of supplies of nets of suitable weave, (4) failure to inspect nets for defects, and (5) lack of supervision on the mode of their employment. It is difficult to assess the degree of protection nets can afford during operations, but it was an appreciable factor. At a later date, at the end of March 1944 the whole of the 7th Division, then nearing its time of relief, showed a malarial rate of 11 to 15 per 1,000 per week, while the 18th Brigade, undertaking a difficult operation, had a rate of 25 to 30 per 1,000 per week, rising later to 45. A factor in this rise was probably the accidental leaving of nets behind.

Slips and failures were often conditioned by human factors, and are not wholly unavoidable, but they were too many in these campaigns. This may be again reinforced by figures: during the period 5th September 1943 to 17th March 1944, 9,942 men were evacuated to medical units with malaria out of a total of 28,059 Australian troops engaged on the northern coastal areas of New Guinea. The greatest danger appeared to be due to early infection by adult mosquitoes already in the areas on arrival of the forces, and to inefficiently controlled breeding both in base areas and the areas occupied by front-line troops. The fighting units needed further discipline and training, and more malaria control units were necessary, with adequate transport, stores and equipment. The sooner in an operation such measures could be put into effect the better would be the degree of control achieved.

The relative safety attained in staging and concentration areas such as Milne Bay, Buna and Kelanoa showed how preliminary hazards to troops assembled in these sub-bases could be minimised and practically abolished. The next objective was the more thorough diffusion of these principles and practice through all troops sent or likely to be sent to forward areas.

These generalities cannot readily be applied to different units or formations unless all factors are known and taken into account. The 7th and 9th Divisions, for example, had very different assignments; though both, in the main, were in highly malarious areas. The 9th Division was relieved by the 5th Division on 20th January 1944, while the 7th Division was not fully relieved by the 11th Division until 8th April. The 7th Division had suffered an alarmingly high malarial rate in December, but after a higher dosage of suppressive atebrin was ordered, the formation showed a much lowered rate, and was able to continue active operations. Early in January the 21st and 25th Brigades were relieved, and the 15th and 18th Brigades began the assault on Kankiryo Saddle on 19th January. The 15th Brigade in particular had made the most of its experiences in the fighting before Salamaua, and had evolved and carried out a most successful anti-malarial discipline. The average malarial rate for the formation was only 7.6 per 1,000 per week during the fighting which drove the Japanese out of their holdings along the coast north of Bogadjim. Though the relieving divisions continued this drive up the coast, the original objectives of the 7th and the 9th had been gained, and rehabilitation of the men soon began and was successfully carried out once they had been transferred to the Atherton Tableland. A high malarial relapse rate was soon manifest after suppressive atebrin had been discontinued, a practical demonstration of the prevalence of B.T. infections, and the efficiency of atebrin as a suppressive. This practical proof came in a very convincing fashion, just as the scientific proof had been obtained in the Medical Research Unit at Cairns. Notwithstanding the military success of these campaigns, and the ability of the medical services to keep enough men fit to continue active fighting till the end was gained, the cost had been high. The effect of this wastage of men persisted for some months till the health of the men was restored to its previous high level. Loss of weight was common, post-malarial anaemia also needed treatment, and hookworm, also a significant cause of anaemia, was found to be fairly common, but yielded readily to treatment.

Further campaigning of Australian forces lay ahead, and it was natural that the Australian military command should turn to the medical directorate for a full solution of the problems of preventive medicine.

OTHER INFECTIOUS DISEASES

Mite-borne typhus fever. The end of 1943 was a period in which the incidence of typhus fever in New Guinea reached its peak. Both before and after this period of time the characteristic patchy incidence of the disease was observed. Units would move into another area, and the incidence rate would fall, or rise, according as mites were prevalent in the sites occupied by the troops. Twenty-nine cases diagnosed as scrub typhus were observed among the first 700 admissions to the 2/6th Field Ambulance. At this time too, a drive was made to insist on regular and correct application of mite repellent lotion, dibutyl phthalate. Thus two important factors governed the incidence, location and the proper use of



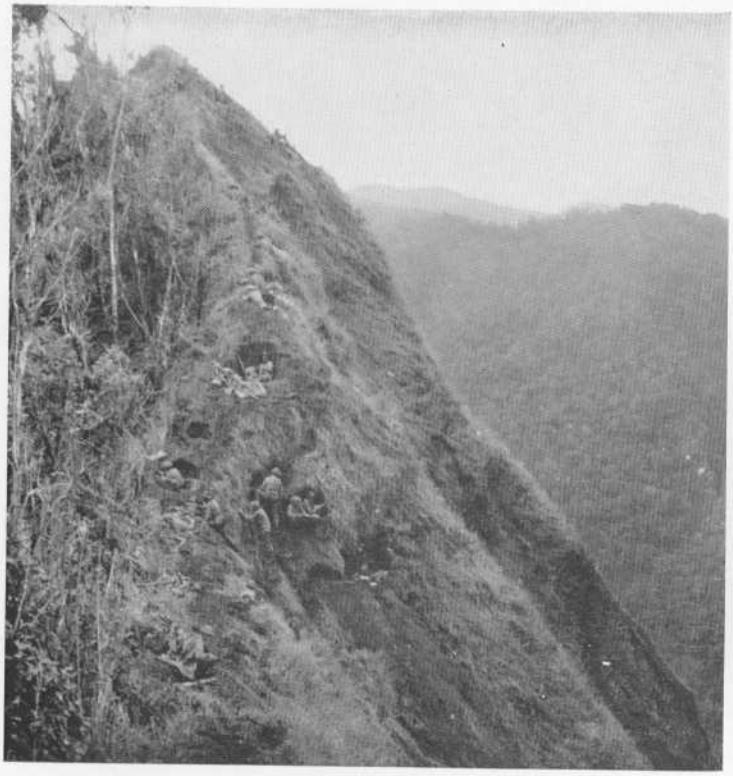
(Australian War Memorial)

The 2/4th Field Ambulance M.D.S. at Dumpu.



(Australian War Memorial)

Carrying wounded of the 57th/60th Battalion to the A.D.S. at Saipa.



Green Sniper's Pimple.

(Australian War Memorial)



Stretcher bearers arriving at the R.A.P., Shaggy Ridge.

(Australian War Memorial)



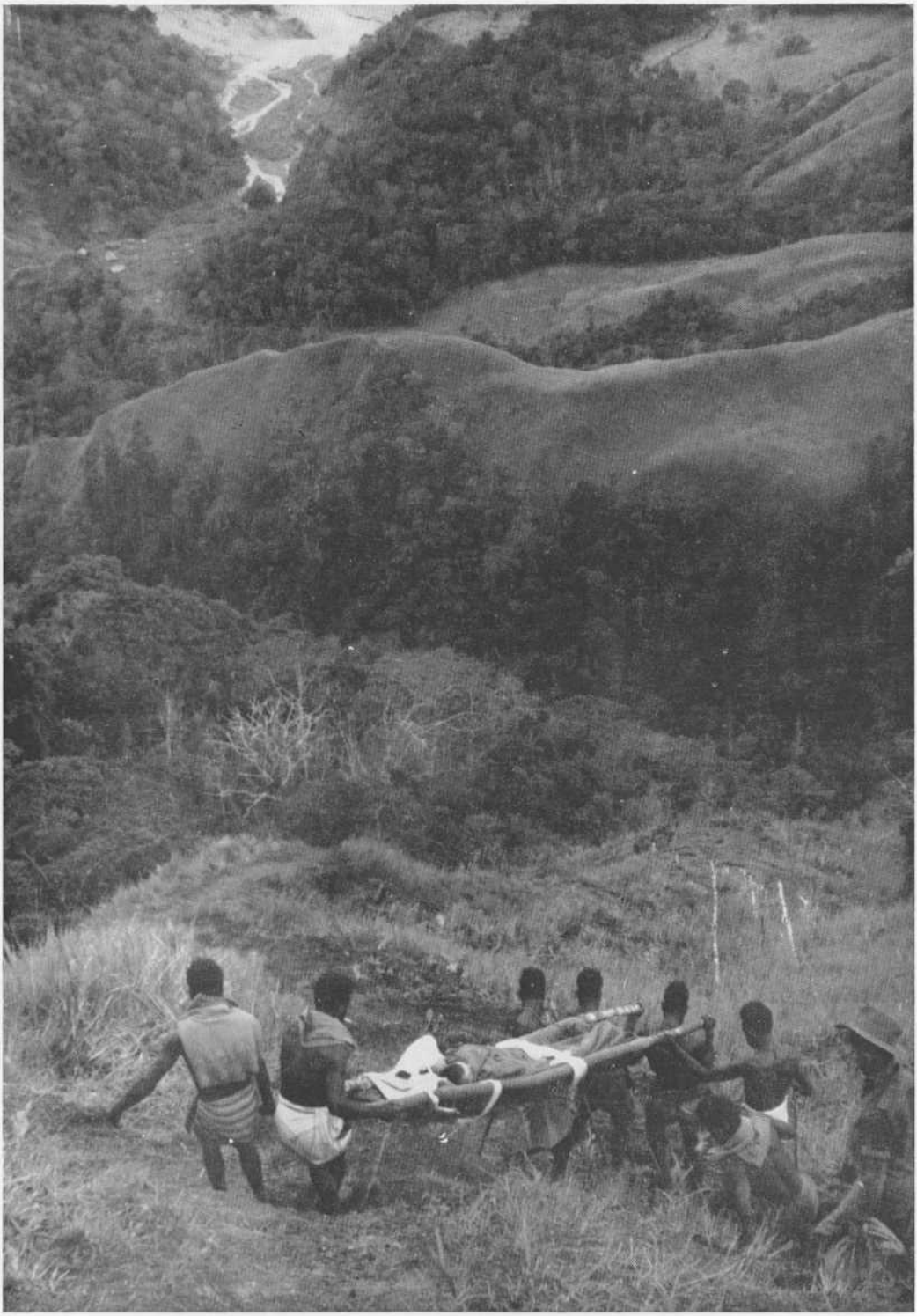
(Australian War Memorial)

Stretcher bearers carrying a patient from a forward aid post to the R.A.P. during the fighting on Shaggy Ridge.



(Australian War Memorial)

The 2/9th Battalion dug in at forward positions on Shaggy Ridge.



(Australian War Memorial)

On the way from Shaggy Ridge to the A.D.S. at Guy's post.

miticide: of these the latter was under the control of the soldiers themselves. Fortunately, individual proof of the effectiveness of this lotion was easily established, as "mokka" bites no longer worried the men who used the preventive.

In the Markham and Ramu Valleys dibutyl phthalate was available to the troops from the end of November 1943. During September and October the 21st and 25th Brigades had forty-two and fifty-two cases of typhus respectively; during October and November, while in a more static role the incidence was twenty-seven and thirty-four cases, but in December on similar duties, when mite repellent was used, the numbers fell to eleven and ten. The 15th and 18th Brigades relieved the 21st and 25th in January, and during two months of active patrolling and fighting, still using repellent, reported thirty and three infections respectively. In the following months the numbers were negligible. Enquiry showed that in practically every instance infected men admitted failure to use repellent or incorrect mode of use. McCulloch in his study of the control of scrub typhus[2] pointed out that the decline in the infection rate may have been due in part to decline in the degree of infestation of the areas occupied by troops, but the only cause known for this would have been stabilisation of camp sites, which did not apply in the Ramu Valley. Similarly, the possibility of the formations concerned avoiding infested areas was quite apart from reality. The conclusion seemed well based that the correct use of anti-mite fluid would control typhus in a force in the field.[3]

In November 1943 the 7th Division promulgated an instruction on the prevention of scrub typhus in which concern was expressed for the rising incidence, and the method of use of the repellent was clearly described. In addition practical instruction was given to the men, and a quantity of 3 ounces per man per fortnight was laid down.

In the 9th Division areas the problem of typhus caused similar anxiety: in the Lae area, including Nadzab, sixty-six cases were reported in the twelve months preceding December 1944, and in the Finschhafen area including the coastal terrain up to Saidor, the number was 194. The totals for the two divisions were practically the same, and the same decline in numbers was seen in almost every area after the middle of 1944.

Diarrhoeal diseases did not cause a serious degree of disability in these campaigns. In some settled areas and during some campaigns the risk of spreading bowel-borne disease came almost solely from within the affected units. In operational areas of New Guinea this was not always so; other sources of infection were the Japanese and the natives of the country. Since the demonstration of its power to arrest an epidemic of dysentery on the Owen Stanley Range, great faith had been reposed in sulphaguanidine, and its production in Australia had made its wider distribution possible. During the operations of both the 7th and 9th Divisions outbreaks of diarrhoea had occurred; some of these had followed the occupation of areas recently held by the Japanese, others were associated with

[2] *The Medical Journal of Australia*, 25th May 1946.

[3] Allan S. Walker, *Clinical Problems of War*, p. 195 (Volume I in this series).

increases in the fly population. The latter were occasionally associated with the presence of numbers of Japanese dead before the areas could be cleaned up, sometimes they were more simply due to neglect of rigid sanitary precautions. Even in this country of high rainfall there was occasional scarcity of water in inland areas where supplies did not always permit enough for washing. Water was generally drawn from fast-running shallow streams, but bulk sterilisation was usually not possible during the early months of the campaign. At Scarlet Beach only two water-tank lorries were available for the division, even so late as a month after the landing. The only alternative, sterilisation by individual sets, had obvious drawbacks, as it was so hard to supervise, and in addition the sets at first supplied were faulty, the sterilising tablets disintegrating before they could be used. Later issues were improved, but a good deal of faith had been lost in them. It must be admitted that it is extremely difficult to dissuade soldiers or civilians alike from drinking water which, despite its deceptive clarity, may be infected. Further, it was realised by the responsible advisers in matters of hygiene, that to trust to an undoubtedly effective drug like sulphaguanidine to neutralise any serious results following the ingestion of infected material, was introducing a wrong principle. Consequently the hygiene services, working under a reorganised method, steadily policed methods of sanitation.

Brief consideration must also be given to the potential danger of a serious epidemic of dysentery among natives in New Guinea. The real possibilities of such an outbreak were obscured by the limited contacts with native communities made by most medical officers, except those of Angau, and by the usually mild nature of outbreaks of dysentery in both service and native populations. A striking example of this was seen at the end of 1943 in the Chimbu area west of Bena Bena, and east of Mount Hagen where there was an Angau post. Dysentery broke out at the end of October in the central plateau, which carries a high population, probably 200,000, of whom 50,000 were in the area concerned. From 13th November 1943 to 15th January 1944, 3,000 natives were admitted to hospital, and more than 100 of them died. The actual mortality was probably considerably higher than this; it contrasts sharply with the complete absence of fatal cases in the Australian Forces. The onset of the disease in severely affected natives was acute, and without specific treatment dehydration and collapse were manifest, and within a week of onset death occurred. Sulphaguanidine had a remarkable effect on these patients. Even when administered on the fifth to the eighth day, the general condition showed rapid improvement, the stool ceased to contain blood and mucus, and in four to eight days became normal, with full recovery of the patients in two weeks or less. A special medical officer was made available by the D.D.M.S., New Guinea Force; he investigated the outbreak and gave advice on measures of control. With a neighbouring population of 50,000 open to attack by the epidemic, the danger was great. New hospital huts were erected to house some 700 patients, proper sanitation installed, and movements of natives controlled. Jeeps and trailers were supplied for

transport purposes, thus saving the use of transport trains and limiting ordinary road travel with its risk of spreading infection. Other areas were affected by spread from Chimbu, such as Bena Bena, but Chimbu, with its high population remained a hazard for some time. Some 50,000 tablets of sulphaguanidine were used, and even this amount was inadequate. This epidemic shows how dangerous such an outbreak could become, and how serious a disease bacillary dysentery is in its uncontrolled form.

The incidence of infective hepatitis may here be considered, as it should be included as a disease spread from the alimentary tract. During 1943 many cases of infective jaundice were seen in base hospitals; most of these came from the forward areas, probably owing to the closer contacts of groups of men whose hygiene was not as faultless as could be desired. The incidence of hepatitis rose from 3.93 per 1,000 per month in 1943 to 9.25 per 1,000 per month in 1944. No doubt the rising figures for most infectious diseases seen in fighting formations were due to the greater impact of the infective agents upon men exposed to hardship in all conditions of living.

Skin disorders also began to increase in number during this period; on a much larger scale this corresponded with the experience of the A.I.F. in the Middle East. There was no doubt that as the campaign progressed skin infections increased in number. Great increase was also observed in other dermatoses not primarily infective, but related to the greater traumatic insults and physiological strain imposed on the skin of men living and fighting in a tropical climate. There was still a tendency to cast most of these dermatoses into the category of "tinea" often with unfortunate results. The feet and the flexures were often involved in lesions of the skin causing considerable disability, which the necessity for wearing protective clothing tended to increase. At this stage the rising graph of malaria with its alarming peak in December 1943 obscured the frequency of disorders of the skin, but by the middle of 1944 their incidence had risen to that of malaria and began to exceed it. Perhaps only dermatologists saw clearly how great a wastage was to come from this source.

SURGICAL TEAMS

During the operations in the Huon Peninsula and from the Ramu Valley to the coast, surgical work followed established methods, with sufficient elasticity of organisation to conform to the military needs of the circumstances. Different factors were introduced in combined operations, and amphibious landings, and the increasing use of air transport and evacuation by sea-craft called for appropriate arrangements. A surgical team was detached from the 2/7th and one from the 2/11th A.G.H. to carry out surgical work during the fighting on the Huon Peninsula. Other teams were assigned to this work in the Ramu Valley, and where the military situation demanded more help, other teams were formed. The principle of lessening the distances and times of transport of wounded as far as practicable was maintained, so that surgery was carried out well forward in many instances.

The composition of the surgical team from the 2/11th A.G.H. illustrated the use made of well-equipped personnel. Two surgeons, Morris and Bolger, and three orderlies comprised the team. Two of the O.Rs. had experience, one was well trained in the Middle East in theatre routines, another had experience in surgical wards and was soon adapted to theatre work, while the third was valuable as a batman and could prepare patients and wash theatre linen. Another orderly would have been of great value. This team landed with the headquarters of the ambulance in the actions on Lae and shared in preparation of an M.D.S. with operating and resuscitation tents. Later they took part in a landing at Scarlet Beach against Japanese resistance. Extemporisations were necessary in this action, and resuscitations were carried out in the open with bottles of serum hanging on trees. After some weeks of hard work this team participated in the transfer of patients, mostly non-surgical, by barge down the coast when the enemy counter-attacked. A team from the light section of the 2/3rd C.C.S. accompanied the patients, and worked with the staff of the main section of the unit. This example shows how a team could be picked from a medical field unit, which cooperated with the team both in technical procedures and in general care of the members of the team, who had to rely on the housing unit for maintenance.

These arrangements illustrated how the methods of using a surgical team in these campaigns were much less elaborate than those necessary for a formally established and fully equipped mobile surgical team. It was found advantageous to be somewhat self-contained, and circumstances of evacuation dictated the length of time necessary to hold patients. Row has stated that the administrative and tactical side of field surgery is most important, and that the average surgeon finds the actual operating the easiest part of all. Forward teams had also to be prepared to move with the ambulance detachment with which they were working: the type of accommodation found convenient for removal and re-erection has been described elsewhere. In bush carpentering Sisalkraft was found most versatile and convenient, and facilitated movement or rapid erection of shelters, for instance, for early use in amphibious operations. Tents were useful, but had disabilities. The American pyramidal tent could easily be blacked out but was hot: the E.P.I.P. tent was weighty and needed mechanical transport, but otherwise was roomy and convenient. A floor of corduroy helped to keep the feet dry; most operating tents were dug in to a depth of about four feet for safety in attack.

At Finschhafen two operating tents were used, one on each side of the main traffic track of the field ambulance: this permitted one theatre to be used by the unit staff, and another by the surgical team. Separate preparation and resuscitation tents were used here and were most desirable. A little later at Sattelberg a roomy comfortable theatre was constructed from salvaged galvanised iron; it accommodated two theatres.

Mobile lighting equipment was necessary: pressure lamps gave a good light but were hot and not trouble-free. Generator sets were very satisfactory; the American field unit operating lights and generator were used by

the surgical teams with the 2/4th Field Ambulance in the Lae-Nadzab area, and were found most satisfactory. A signalling lamp was found most useful as a spotlight. The weight of operating equipment was important. Morris pointed out that a surgeon working at an advanced dressing station can restrict equipment to a weight of 400 pounds. Most of this could be sub-divided into 40-pound lots, using a tin of plaster as a weight. An autoclave could also be carried if divided into three parts.

The mobile nature of teams may be illustrated by the following details of movements over several months. In the Markham and Ramu Valleys surgical teams were available for work with the units of the 7th Division from September 1943. Captains W. P. Ryan and Leggett worked with help from Majors Stuckey and Goulston at Lae, and Captain F. D. Smith with the 18th Brigade. A team was attached to the M.D.S. at Nadzab at the outset of the campaign, and later at Dumpu. In December surgical casualties were treated from the 2/6th Commando Squadron, 2/25th Battalion, and the P.I.B. in the Kesawai area. At the end of 1943 a surgical team established a post with the 2/4th Field Ambulance, to serve operations on the Kankiryo Saddle and the action of 2/10th Battalion at Shaggy Ridge. Early in January Leggett went on foot with two orderlies to Geyton's post, behind the 2/12th Battalion, and set up a surgical post there, while Ryan and Smith went to Guy's post. In February Ryan returned to his unit, the 2/9th A.G.H.

In the preparation and assembling of the equipment of these teams a definite advance had been made in July 1943, when the D.G.M.S., in consultation with Colonel W. A. Hailes, Director of Surgery, had tables drawn up setting forth the surgeons to be called upon for teams and their locations, and indicating which units held the equipment and which were responsible for the training of orderlies. This training was designed to enable the orderlies to carry out responsible work efficiently in the team, and was given a practical basis. The supplies arrangements ensured that stores were available and packed ready for immediate despatch in hardwood boxes that could survive the journey to New Guinea without loss or wastage. Authority was given later on in 1944 for one additional set of ordnance equipment for a surgical team from each of six general hospitals (2/1st, 2/2nd, 2/5th, 2/6th, 2/7th and 2/9th) and for the issue of one set to the 2/4th and 2/12th Hospitals.

The question of age for surgeons was raised. No special physical preparation had been made to fit them for a task which was arduous and called for long hours; and the A.D.M.S. 9th Division suggested that a certain amount of training, as by marches with full packs, would be advisable at the unit of origin of each team. A blend of youth and experience was found advisable; it should be noted that illness was not uncommon among members of teams which had been working continuously for some weeks or longer. Ackland expressed the opinion that eighteen hours of continuous work was the upper limit of the amount of work which should be asked of members of a team. Where two teams were working in the same centre, the surgeon and orderlies worked eight hours in the theatre;

and then eight hours seeing patients as they arrived, or supervising post-operative treatment. The order of duties was changed daily so that each surgeon could have eight hours' rest each day. Selection of patients for operation always needed judicious care; so too did selection for evacuation. For example it was not desirable to send away patients with wounds of the chest, or abdomen, who travelled badly, and except in early stages, those with wounds of the head. This was particularly difficult when a trying journey faced the patients, such as the 60-mile trip by sea in small barges from Scarlet Beach. Men in Thomas splints might be moved successfully on barges, but would have small chance of survival in the event of enemy action. Even in exceptionally rough country such as the Finisterre Range a man was carried in a Thomas splint with little discomfort with the aid of sedation.

Morris pointed out that during a period of three months in the latter part of 1943 his team dealt with 400 casualties, and although this number was often surpassed in the 1914-18 war, the surgeons were very busy during certain periods, such as those following sustained actions. The difficulties of climate and terrain need no further emphasis, nor the hazards of disease; their nature made the comparison of results in different areas very difficult. Attempts were made to produce results in the surgical treatment of abdominal wounds comparable with those of Major T. Giblin in the Middle East. New Guinea doubtless gave a much more unfavourable background for this critical type of surgery, and these conditions probably accounted for a recovery rate not exceeding 33 per cent.

In organising work for two surgical teams it frequently happened that one surgeon out of four was temporarily not available through illness; some refinements of surgical work had to be omitted, but none which were of real import. For example, gloves were usually worn only for major operations, as sweating was so profuse, and gloves had a short life. Trousers, boots, gaiters and water-proof apron, cap and mask were worn; gowns were not worn except for wounds of abdomen, head or femur. Sheets were also reserved for major operations: water-proof squares soaked in an antiseptic were otherwise sufficient.

Phosphorus bombs were used in at least one enemy attack. Fragments were seen smoking in the wounds, even at a deep level; these were extracted as far as possible and water applied, as well as a copper solution, followed by boric lotion. A special instruction was circulated to all medical officers setting out the procedure to be followed.

The routines adopted for wounds of various regions were those already well known to the surgeons of Australian armed forces, and the standards of the work done were kept high, not merely by the keenness of the men themselves, but by educational methods, such as clinical discussions when opportunity arose and by the use of consultants in an advisory capacity. An experienced surgeon was detailed to an area for a period, during which he consulted with medical officers in relation to surgical problems. Hailes and his surgical consultant colleague, Littlejohn, kept in close touch with their officers, and the latter, freed from many of the

headquarters routines, gave medical officers in forward areas the benefit of his activity and surgical skill and judgment.

Gas infections of wounds were fortunately rare. Captain J. W. Perry in a special investigation found that at the end of 1943 the frequency of *Clostridia* in New Guinea corresponded to that found in previous actions. Though antiserum was used for cases of undoubted infections, adequate excision of wounds and blood transfusion were thought more important. Littlejohn maintained constant vigilance on this need for correct degrees of excision, and it is fair to state that the relative rarity of serious anaerobic infections of wounds was a result achieved by an efficient system of evacuation in most difficult country, the construction of improvised forward surgical centres, and a correct application of surgical principles. The external conditions in New Guinea were those favouring the development of gas gangrene, and that so little trouble ensued is a tribute to the whole surgical organisation: in other words it was a successful application of preventive surgery. Further advances were exploited in the use of penicillin, then being found so valuable in the campaigns in Italy, and the results of suture under protection of penicillin were promising.

During January, the team under Captain W. P. Ryan at Guy's post, with assistance of extra orderlies, was able to give continuous service to men wounded during the action for Kankiryo Saddle. Help was also given in anaesthetics and resuscitation by Edelman in charge of Guy's post and Captains J. Fairley and Bracken. In this post 82 operations were performed, one on a man with acute appendicitis: ready cooperation between the team and the ambulance unit resulted in a high degree of efficiency.

Opportunity was given for members of the ambulance staff serving in detachments to visit other neighbouring posts so as to familiarise them with the country and to increase their degree of independence. The need for a high standard of work entrusted to nursing orderlies was stressed by officers working with surgical teams, especially when seriously wounded men, such as those suffering from abdominal injuries, have to be kept in a forward area during an anxious post-operative period. It was essential that the medical officers realised the magnitude of their own responsibility both in directing treatment and in educating orderlies in carrying it out.

On 10th February, after the action at Shaggy Ridge, a conference of R.M.Os. and ambulance officers was held and certain conclusions reached from their joint experience have already been summarised. In general, evacuation of casualties was successfully carried out, but their movement was greatly helped by the moderate numbers, spread over a long period. All transport was insufficient, only a few native bearers were available, the terrain was difficult and the climate was trying. These conditions multiplied difficulties, such as lack of cover for patients, and increased the time taken for casualties to reach forward medical posts. This disturbance of the time factor in bringing casualties in for surgical treatment added to the risk which would have been more evident had the numbers been greater.

The general conclusions reached were that the R.M.O. should always be kept informed of the affairs of his unit, that ambulance officers should have opportunity for familiarising themselves with the country, that aid posts should be as far forward and as central as possible, that reasonable facilities should be provided not only for the movement of wounded, but also of equipment. In this connection it is interesting that the natives needed to close Geyton's post numbered 181, made up as follows: eight teams of twelve to move patients, twelve to carry surgical gear and five medical material, forty-five to move kitchen equipment and rations, sixteen to carry tents and seven to take stretchers. The need for Angau representation for control of natives at the battalion end was also stressed.

During the engagement one of the old problems emerged again from the work of surgical teams, that is, the question of administrative authority. This was discussed during the first Libyan campaign, and was then amicably settled, though it recurred at intervals later. At the beginning of the final action on Shaggy Ridge Refshauge brought up the matter for settlement by the A.D.M.S. as to who was in charge of the work, the commander of the field ambulance or the officer in charge of the surgical team. The A.D.M.S. clarified the position and pointed out that the surgical team was not regarded as an independent unit, but attached for duty, rations and discipline to the field ambulance. This problem is liable to recur both in service and civilian circles; its best solution no doubt lies in basing conditions of work on a firm agreement between the parties concerned.

CHAPTER 12

IN AUSTRALIA 1943-45

THE beginning of the period 1943-45 proved later to be a turning point in the Allied fortunes in the Pacific War, though this was not apparent at the time. Part of the military population of Australia was directly concerned in operations, though not sundered by so great a distance from the mainland as in the earlier episodes of the Middle East. Occasional periods of leave lessened their isolation from home, and to a less extent, periods of rehabilitation and training, usually on the Atherton Tableland in North Queensland. Militia troops were more concerned in these experiences as time passed, especially after 19th February 1943, when the Australian Government passed a bill empowering the sending of the militia anywhere in the South-West Pacific Area. An order was promulgated also that any militia unit which included three-quarters of volunteers in its ranks could make application for acceptance as an A.I.F. unit.

To these classes of what may be called "fighting troops" must be added the large numbers used for purposes of defence. Many troops were retained for this purpose, in one instance at least, consisting of specialists such as the Armoured Force, which were substantially reduced during this period, as there seemed no likelihood of their being used overseas, excepting to a limited extent in the island campaigns. The centre of gravity of defence was more obviously to the north of Australia, and a considerable body of troops was maintained in the Northern Territory, known as Northern Territory Force. This force had special problems and difficulties, some being medical in nature: these will be dealt with later.

Other factors were of increasing importance, chiefly those related to tropical disease, which was causing at least a 7 per cent wastage of troops actively engaged in hyperendemic areas. As the areas held in New Guinea and other islands increased in size and strategic importance, the task of the Australian Army became more and more centred there, and reduction of troops in other areas became necessary. The maintenance of twelve divisions in a population then not exceeding seven millions became too great a task without risking attenuation of the force. New Guinea needed three divisions, with three more in reserve, and the rest of a force comprising in all nine infantry divisions.

The strain of service requirements on the medical personnel both in and out of the Services was somewhat lifted by these adjustments. The effect of war on the life of civilians varied to some extent in different areas. The proximity of military formations had some influence on this, and it is curious that during war a degree of antagonism may be detected between the Services and civilians. It is perhaps akin to the well-known combination of admiration and hostility seen in families. The relations of doctors in practice and that section of the public needing medical attention occasionally showed strain too. Civilian doctors were reduced in number,

they carried more than their usual burdens and in addition, the extra burden of age, for the ageing medical man came back to help. The remaining practitioners were invariably engaged in part-time work connected with the war, and they had difficulty in obtaining necessary drugs and appliances for use in practice. Hospitals suffered similar disabilities, and their buildings often housed Australian or Allied medical service units. It was fortunate that adequate steps had been taken even before the outbreak of war to coordinate the work of the medical profession and its ancillaries. This work had gone on steadily during the first half of the war years, as has been recounted in the previous volume.

COORDINATION IN 1943-45

In 1943 Colonel Sir Alan Newton resigned from the position of Deputy Chairman of the Central Medical Coordination Committee and Lieut-Colonel W. G. D. Upjohn was appointed in his place. The retiring Deputy Chairman thenceforth was able to devote more time to the exceedingly pressing problems of medical equipment; he left behind him an efficiently running organisation, whose momentum and experience would be of high value in overcoming difficulties ahead. These were mainly concerned with the chief duty of the C.M.C.C., the maintenance of balance between civil and service medical requirements. At one end of the chain were the universities, charged with the education of medical practitioners under stringencies of reduced staff and facilities. At the other end were the vital needs of the armed forces, whose demands were not always predictable. Between were the over-worked civil practitioners, and the anxious, strained civilians, with an undue proportion of older people, already beset with growing difficulties in everyday living.

Some degree of control was exercised over the university medical courses. A quota system was controlled by the Commonwealth Government, intending applicants being required to intimate their intention before leaving school. No call was made on intending medical students until it was decided whether they would be included in a quota, the selection for which was made purely on academic qualifications. No preference was given to Australians over aliens. Students failing to gain inclusion in the quota automatically came under control of the manpower authorities. In 1944 the army agreed to discharge soldiers to commence or continue medical courses, if approved by the Director-General of Manpower and the Universities Commission. The B.M.A. Federal Council pointed out in 1945 that these conditions discriminated against soldiers who through ability had attained rank over that of corporal. The conditions were later made less restrictive.

In 1944 the medical manpower position was reviewed: the total number of civilian doctors was then, in June, 4,166; in 1943 it had been 4,032. The manpower director and the Universities Commission wished to know how many medical men would be released and how many called up over given periods in 1944 and 1945. The position did not warrant the release of one medical officer for every practitioner recruited. A statement was

issued by the Medical Directors of the Services setting out the reasons why medical officers could not then be spared from the Services; this statement was published in *The Medical Journal of Australia.* It pointed out that, in order to avoid wastage of doctors, the establishments for medical units and formations were not filled, and the army and the air force were considerably below strength. The wastage rate of medical officers in the Services, which was considerable, was hardly equalled by the intake. In spite of the lessened threat to the Australian mainland, the numbers of Australian forces committed in active operational areas was greater than ever, and the very nature of these areas involved a high sickness rate. In the navy, doctors serving at sea must perforce be distributed among ships of various types and no simple ratio of medical officers to men was practicable. Emergencies showed that even the medical staffs carried were barely adequate. Considering that the medical services of the armed forces looked after about one-eighth of the total population of Australia, and were of necessity so strategically placed that full attention to men under emergency conditions could always be available at short notice, the numbers so employed were far from excessive. In addition, preventive medicine, itself a great sparer of human wastage, absorbed a considerable number of doctors. Steps had been taken to detail medical officers in Australia to relieve civil practitioners in need of rest, and, in 1943, 162 medical officers, 125 on full-time duty, had been released from the army. In the air force similar steps were being taken. In issuing this statement the Service Medical Directors emphasised their awareness of the medical problems affecting civilians, and their active cooperation in measures which would help to solve them. Relief was given to civilian doctors in all parts of Australia from time to time by assigning a service medical officer to the duties of a private practice. The numbers available were not great, and the time of relief was usually short, but the results were good. The service medical officers made no financial gain; the usual fee for a *locum tenens* was paid into general funds, while the relieving doctor welcomed the opportunity of a brief period of professional value to all parties, and felt the benefit of making contacts of very different kind to those of service medicine.

In inaccessible areas occasional visits were made by medical officers by air to patients unable to travel. At Alice Springs a service hospital, the 109th A.G.H., carried out all varieties of medical and surgical work, including obstetric care, using the civilian midwifery block. During 1943, fifteen such cases were attended in three months. Help was also given in the central areas in the flying doctor practice, and arrangements were made for army medical officers to examine aliens working under the Allied Works Council in Central Australia. Evacuees were also given medical care by service personnel and when malarial suspects passed through from the occupied islands to the north they were given necessary observation.

These activities dislocated civil administration to some extent in respect of medical services, but agreement was reached that the army would assume responsibility for treatment of civil cases in the whole Northern Territory while military occupation continued there. Some difficulties

arose. For example, at Brunette Downs there were complaints, as the civilians wanted an improved service. The administrator wanted a regular patrol of doctors through certain areas, but only a restricted service was possible in view of the scattered population and the great distances.

Civilians could also obtain special types of treatment, such as facio-maxillary and plastic surgery, if approval was given by the Adjutant-General and the D.D.M.S. of the Northern Territory Force. No full-time medical officer charged or received a fee, but indemnity against the claim was signed by the patient. It was agreed that reversion to ordinary civil control would be made as soon as this was practicable. Manpower shortages prevented the Commonwealth Department of Health from taking it over until the end of the war.

Even in urban populations there were regional shortages of doctors. In the Illawarra district in N.S.W. for a time during 1943 the ratio of doctors to patients fell to 1 in 5,000 and in Bankstown to 1 in 8,000. (By comparison the ratio rose early in 1947 to 1 in 1,000.)

At June 1943 the number of army medical officers on the Order of Battle was 2,082; that on the active list was 1,464. By effecting savings in various ways 33 per cent was thus saved on the Order of Battle. In October the same year the war establishment of medical officers was 1,932, and only 1,565 were on full-time duty, 43 of these being about to be released. When the end of the academic year came the position was expected to be further relieved.

It was evident that many question were being asked about the number of doctors in the Services. These questions came not only from the public: explanations were required by the Department of the Army in October 1943. General Burston on this occasion pointed out that a comparison of percentages of medical officers in the armed Services at war and in a civil community served no useful purpose. The ratio of the former to the latter was inevitably higher. It is true, of course, that numbers of medical officers complained of times when they had little to do. Usually, however, men of resource could find useful tasks, even though these did not fall within their usual duties. At times, when for example units were waiting movements, delays were unavoidable.

An important step was taken in 1943 which helped the ideal of equalisation of effort and sacrifice. Medical officers over forty years of age were circularised in order to ascertain who were willing to return to civil practice. No promise was implicit in this circular, but when permission was given by the forces, the way was made easier for the coordination committees to replace the senior men by recent graduates. During the previous two years most of these young men had been taken into the Services, and as a very large number of the medical men remaining in civil practice were over fifty years of age, and many considerably over it, the strain was increasingly felt. On the other hand, there were medical men in the Services over forty who were not qualified as specialists, nor fitted for promotion in the Services to carry out work of special type. As some form of priority had to be considered in carrying out this plan,

those medical officers who had served in a theatre of active operations would be considered first, otherwise those with longest service were given preference.

As time went on this plan worked very well. Criticisms were occasionally heard, some from members of other arms of the service, who were inclined to forget the claims of health in the civilians at home, and others from doctors themselves, who were occasionally inclined to take umbrage at a suggestion which was meant to benefit the community. The Services' Medical Directors prepared a statement showing the Defence Committee the manpower position of the medical officers and nurses with regard to releases and intakes during the period 1st June 1944 to 30th June 1945. The posted strength of medical officers in September 1944 was 1,410, as against 1,565 a year earlier, and during the stated period 241 doctors were released and only 116 enlisted. This was made possible by the lessened number of units employed in an operational role in 1943.

However, the period 1944-45 was expected to see a greater number of troops engaged in operations in tropical areas than at any time during the preceding war years. Even allowing for an expected reduction in casualties from malaria, this might be offset by inroads by other diseases, and reductions in units on the Order of Battle could not safely be entertained. At home, the care of repatriation patients had been accepted, and an elaborate mechanism was growing up for this national duty, and first-rate hosptials were being built; and the care of civilians and natives in certain areas was also likely to increase medical work. Therefore the following figures were presented by the D.G.M.S. of the Army:

	Medical Officers	A.A.N.S.
War Establishment as at 30th September 1944 .	1,620	3,333
Posted strength as at 30th September 1944 . .	1,410	2,631

These considerable deficiencies, 210 medical officers and 702 nurses, and the expected numbers of 800 medical officers and 1,200 nurses overseas, with a probable heavy wastage rate, left only the depleted units on the mainland as a source of reinforcements. Burston warned that these strengths must be maintained, particularly those of nurses if the work was to be carried out properly. In August 1943, the committee approved of the principle of granting exemption from portion of the training required of nurses for registration, by women who had undergone that training provided by military hospitals.

During 1943 a severe outbreak of typhoid fever occurred on the outskirts of Melbourne and nurses from the army and air forces were made available for this work in the civilian community.

In July 1944 the Director of Manpower made enquiries concerning the easing of the position with nurses for civilian work. In reply the D.G.M.S. of the Army stated that during the past twelve months there had been 2,706 members of the A.A.N.S.; 294 had been discharged and 24 called up. During the same period 2,500 were added to the pool of trainees. He pointed out further, that in disciplined services considerable saving could be effected, as the nurses could be moved about to meet varying needs.

Similar concern was also felt about pharmacists at the close of 1944, and a survey was ordered to discover qualified pharmacists in the A.M.F. who were employed in other capacities, and who could be more usefully employed in civil life.

The C.M.C.C. was very active during this period 1943-45 in expediting the return of officers to civilian activities. In 1944, however, it was noticeable that a saving in medical officers was accomplished chiefly by reduction of war establishments by means which have been previously described. Posted strengths of medical officers were not kept up at a perfectly even rate, however, as enlistments were mainly of young graduates who had a year's experience in hospitals. The method adopted in 1944 was as follows. Most graduates were available during the March-July period, this being the time of graduation, and even with staggering of the intake of these officers over a period of three months, the result was that at July 1944 almost every young medical officer available was already enlisted, and no more would come forward till March 1945. Therefore wastages would reduce the posted strength of medical officers, for not more than twenty accessions were expected before March 1945, and losses from casualties and age would probably be fifty.

However, the course of events was favourable in 1945. The success of preventive medical measures in Borneo lessened the possible wastage by illness there, and the comparatively small resistance encountered, and the successes in other island fronts enabled the Australian forces to discharge their commitments without undue strain on the medical services. The accelerated pressure on Japan finally brought hostilities to a close in August 1945 and the position was entirely altered.

In July 1945 the need for lifting wartime controls became a subject of practical importance, and the C.M.C.C., following an enquiry from the Prime Minister to the Minister of Health, appointed a sub-committee to consider the methods by which the coordination controls could best be removed. The report submitted traversed the work that had been done, and considered the possible repercussions from relaxation of controls. The committee advised that no immediate relaxation of controls was possible. The needs of the Services were considerable, and large numbers of medical officers were required in routine service work and in the base hospitals. The possibility of evoking the powers of direction of the Emergency Medical Practitioners Service had also to be considered, and it was not thought wise to relinquish these at an early stage. Controls of dentists, pharmacists, and nurses under manpower authorities were also involved, and the Universities Commission still had responsibilities to medical students. After demobilisation the rights of ex-servicemen had to be preserved, and therefore some limitation of students, so far as this was possible, was desirable. Further consideration of demobilisation and its medical aspects must be left till that subject is considered. The relaxation of controls was effected gradually, so as to avoid the confusion of too speedy a release, always with the ideal in view that undue control should be abandoned as soon as it was wise and possible. By the end of 1945 the

Medical Advisory Committee, which had given counsel to the manpower authority on scientific matters, was disbanded. The Central Medical Coordination Committee came to an end on 8th April 1946.

Some of the work done during the war by the Coordination Committees and other organisations concerned in these national activities may be here recapitulated. The chief tasks to be performed were (a) the provision and distribution of medical personnel to the armed forces of the Commonwealth and the civil population and (b) the provision of hospital accommodation, equipment and staff to meet any emergency arising out of the war. In carrying out these tasks the balance was fairly held between the parties concerned. Both armed Services and civil community had their champions on all the committees; this was a good thing. Careful consideration was given to the withdrawal of doctors from the civil community, but as no surplus of doctors existed before the war, and as from one-quarter to one-third of all fit doctors were needed in the Services, no more than an equitable adjustment could be achieved. As pointed out above, medical officers taken from the civil pool decreased in number as time went on, dropping from 2,007 at 21st November 1943 to 1,885 at 31st May 1945.

The acceleration of graduation of medical students was a useful measure, though imposing strain on the teaching schools. The graduates for the years 1934-39 numbered 1,098 and those for 1940-45, 1,740. It was actually possible to release more doctors from the Services in the last two years than were enlisted. This resulted in an increase in the number of doctors available for civil practice: 4,085 at 30th June 1943, 4,353 at 30th June 1944, and 4,550 at 31st March 1945. Fortunately the Emergency Medical Practitioners scheme was not called on to do more than have an adequate organisation ready and waiting for any crisis, and only in a few instances was it necessary to direct members of this service to practise in localities other than their normal place. The measure of extending legal registration beyond its usual restricted State bounds was valuable in conferring greater elasticity on these arrangements, and was essential to ensure medical attention to civilians from service medical officers where no civil doctor was available.

The Standing Committee of Service Directors, established in 1940, gave invaluable service. It was an advisory and consultative body; all its reports were forwarded to the Minister for Defence Coordination through that department's secretary. It was in fact the adviser of the Minister on the coordination of the administration and organisation of the medical services of the armed forces, and on the maintenance of a limited and consistent policy, so that actions of these services should be based on a common ground. The committee further had the duty of investigating and reporting on questions of medical policy affecting more than one service, or requiring concerted action which had been referred to the committee by the Department of Defence Coordination or by any of the service departments. An important duty of the committee was that of bringing to the notice of the Minister of Defence Coordination any significant matter affecting the medical services. The chairman of the com-

mittee was the Director-General of Medical Services of the Army, and other original members were the Director of Naval Services and the Director-General of the Air Force. The executive officer of the Central Medical Coordination Committee and the Deputy Chairman of the Medical Equipment Control Committee were coopted to the committee. Prompt diffusion of the Minister's decisions was secured by communications from the Secretary of the Defence Department, not only to the committee, but also to the Departments of the Navy, the Army and the Air. In its monthly meetings a very wide range of subjects was covered. As Burston, in describing its work, has said,[1]

> Its activities covered any and every interest of the medical departments of the Services: personnel, hospital provision and maintenance, medical equipment, transport by air, land and sea of sick and wounded, hygiene, malaria control and the control of venereal diseases; in fact, anything to do with the health and physical welfare of members of the Services, prisoners of war and civilian communities coming under military authority or control.

Sometimes the problems discussed concerned allied medical services, then medical officers of these services were coopted. The committee also obtained authority from the C.M.C.C. to detail medical officers to act as *locum tenentes* for doctors in civil practice who were unable through illness or other important cause to carry on practice. The same service was extended to hospital medical officers. In anticipation of the cessation of hostilities, the Medical Service Directors' Committee had devised and developed the medical arrangements for demobilisation, with the assistance of the Principal Medical Officers of the Repatriation Commission. The experience hitherto gained in coordination of medical work bore fruit amply in this final important contribution of the medical services; it was truly an inter-service organisation which was smooth and efficient in design and operation.

FINAL COMMENTS ON MEDICAL COORDINATION

The history of the organisations called into being for the realisation of the great aim of medical coordination shows that the aims and powers of the central committee were somewhat whittled down from the original suggestions. However, the process of adjustment produced a very satisfactory organisation which delegated duties and powers in an efficient and orderly fashion, and fulfilled the purposes for which it had been created. It lacked one necessary power, independent executive action. Had the medical profession not been so cooperative control would have been more difficult. Though conscripted early, as pointed out before, and by its own desire, the medical profession has the satisfaction of knowing that its members voluntarily allowed themselves to be conscripted a year before the Government proclamation enacted the conditions they desired for their better service.

Further applications of coordination of medical services in time of war might be made with advantage. These can hardly be dealt with here, but

[1] *The Medical Journal of Australia*, 9th July 1949.

certain deficiencies in an otherwise broad and comprehensive plan may be mentioned. The lack of executive power has been referred to above. Inter-service coordination of establishment to requirements was sometimes not so complete as it should have been. Particularly was this so in hospital resources, and a closer combination of these in base areas and perhaps lines of communication areas might have been advantageous. The common use of consultants and specialists in service hospitals would seem to be advisable in the cause of economy. Other aspects might be mentioned such as complete cooperation between services in satisfying the medical requirements for enlistment, and in securing equal justice for medical officers of all services in demobilisation.

These are but indications of subjects which might be discussed with advantage. After the distinguished service rendered by this organisation it is a matter for regret that when the work of the committee terminated in 1946 it was not at once replaced by a body to examine the possibilities for the future.

EQUIPMENT CONTROL IN 1943-45

PROPRIETARY MEDICINES

Before dealing with the general work of the Medical Equipment Control Committee during the later years of the war, reference may be made to a semi-political subject which has been touched on earlier, and which gave rise to much discussion, that of proprietary medicines. Actually the matter first arose in 1942, but it was not settled till well into 1943. Proprietary medicinal preparations are those sold under a trade mark; there are two types, the ethical and the unethical. The composition of ethical proprietaries is known; they appear in official pharmacopoeias under official names, but are marketed under trade names. They are advertised only to the medical profession. Unethical proprietaries are known more commonly as patent medicines; their composition is not divulged, and they are widely advertised to the public, and thereby gain and maintain a market. Ethical preparations include most of the drugs which we owe to modern pharmacological research, and they have had a great influence in advancing scientific medicine. Their makers usually sell only their own products. In recommending to the Division of Import Procurement the importation of these preparations, the M.E.C.C. was securing a supply of such drugs as sulphathiazole, pentothal sodium, pentnucleotide, anahaemin, sodium amytal, nembutal, decicain, pitocin and many others which were essential for adequate treatment of important conditions. Substitutes were obtained for some of these by importation of alternatives or by manufacture.

The committee was not interested in non-ethical medicines except those which contained important drugs and over which control could be exercised. Early in 1942 the Department of War Organisation of Industry undertook a survey of the field of proprietary medicines, with a view of limiting production and saving manpower.

A member of the department was coopted to the M.E.C.C. at this time, but it was evident that the points of view differed. "Rationalisation"

of this industry was desired by the department, but the committee held that methods successful with such lines as textiles would not be appropriate for drugs. An approach to the drug firms by the chairman produced a list of preparations which they suggested might be no longer manufactured, but little saving was expected thereby, since the drugs listed were in little demand. The chairman drew up a report on all aspects of the subject, covering the methods by which saving might be effected. A special sub-committee held several meetings; these and negotiations with the department did not reveal a solution of the problem, so a submission was made to the Minister for Health and Social Services, whose department was interested in patent medicines. Finally after much discussion and advice from the Director-General of Health, the Production Executive of the Government, to which the question was referred, gave a ruling restricting production of medicines considered by the Department of Health useless for their advertised purposes, and limiting the use of salesmen and advertising. Though a committee representing all the interested departments and the M.E.C.C. was commissioned to make further enquiries, this decision placed control in the hands of the Department of Health. Considerable dissatisfaction was felt by the wholesale drug firms, but regulations giving effect to this ruling after approval of parties concerned were drawn up and gazetted on 20th October 1942.

Mutual Agreement Reached

Meanwhile a sub-committee (Dr J. H. L. Cumpston, Sir Alan Newton, Lieut-Colonel C. W. Ross and Dr B. L. Stanton) began consideration of the formulae of proprietary medicines. The Director-General of Health had obtained specimens of most of these preparations with their formulae from their manufacturers or distributors. Some difficulties became apparent. It was doubtful if restrictive conditions covering all forms of packaging and advertising should apply to drugs; the quantities of essential drugs were found to be very small in many extensively advertised preparations, and their production required very limited manpower. On 5th March, however, the regulations were tabled in the House of Representatives, challenged and disallowed, owing, it was suggested, to intensive "lobbying". It was now evident that no extensive rationalisation could be accomplished by the Department of War Organisation of Industry. Previously more than one adviser had pointed out that attempts to control these products had not been satisfactory or successful in other countries. A mutual agreement was now made. The department undertook to divert salesmen to more essential work, and to limit unnecessary transport of non-essential medicines. The M.E.C.C. agreed to restrict proprietaries on sale at canteens, which was done by limiting purchases, and to continue its strict policy of limiting use of essential drugs. When price control was introduced in 1943, the question of subsidy was raised in some instances, but it appeared that increased costs of proprietaries could usually be borne by the manufacturers, and little recourse was made to subsidies during the duration of the war.

METHODS OF CONTROL

During 1943, after four years of work, the Medical Equipment Control Committee still pursued the same general plan which had proved successful. The main features of this were, as before, encouragement of importation, fostering local manufacture, control and coordination of consumer demand, rationing of supplies, control of exports, avoidance of waste, recording the stock position, consolidation of demands by the Services, and application of general and wartime restrictions to the industries concerned in medical equipment. To this list must be added a number of routine activities concerned with the application of special material or skilled labour to specific tasks, or advising in matters of difficulty of supply or production and many other daily problems solved by the chairman or the chief executive.

Where questions arose concerning action in matters which involved scientific decisions, the committee referred these to the appropriate Scientific Advisory Panel, and thence to the Scientific Advisory Liaison Bureau. Information was then sought by the bureau from laboratories and universities able to give practical help, and the advisory panel was thus able to make a well based recommendation to the committee.

Importation, as previously told, had become more complex in some ways, since the introduction of lend-lease, and in 1943 a mission was despatched from Australia to the United Kingdom and America under the direction of the Division of Import Procurement. It consisted of Mr B. Egan, representing the division, and Lieut-Colonel Ross representing the equipment directorate of the Army Medical Department. At the same time Lieut-Colonel J. A. Doull was sent to Australia and New Zealand from the lend-lease administration in the United States of America to report on medical equipment. Doull reported very favourably on the Australian organisation, and recommended that the local views concerning the essential nature of certain supplies be accepted. The mission did work in the United States which greatly helped in the provision of medical material essential for the war effort in Australia. The results of these personal missions were evident in the prompt arrival of goods from the United States, and in the agreement of the British Ministry of Supply to export to Australia large additional amounts of necessary items. A further practical result was that the requisitions for 1944 could be somewhat reduced. Lend-lease administration was also simplified by the coordination of the overall requirements for the British Empire, the allotting of supplies to Britain and the Dominions being arranged by the missions in Washington. Naturally difficulties and delays in obtaining rail and shipping space were encountered, but there was now good prospect of shortening the delivery times. It will be seen that from now onwards an important function of the M.E.C.C. would be the compilation of advance estimates of medical requirements, having regard to its availability through the trade, by importation or manufacture, or from the United Kingdom. Emergency supplies were occasionally obtained from the United States under license through government cash purchase. By this time

practically all drugs and similar material were under control, and the term "essential" was interpreted very strictly. For example, in many instances only one drug of a group having similar action was included in the list.

MANUFACTURE OF DRUGS AND INSTRUMENTS

Manufacture of drugs was expanding. One noteworthy effort was the production of sulphaguanidine. In 1943 the importance of this drug as a specific for dysentery had been established by its dramatic use in the first Papuan campaign, and the local output of sulphanilamide was diverted to make sulphaguanidine, and it was possible to satisfy all service needs and in addition to allow fifty pounds per week to meet civil needs.

Research by Professor A K. MacBeth also made possible the commercial production of sulphamerazine. This drug had given promising experimental results in malaria in the United States and was, in addition, a potent and useful member of the sulphonamide family. For security reasons it was called "A.S.", and a pilot plant was soon producing twenty-five pounds a week. Full production was expected in a few weeks after the end of the year 1943, when a special factory was completed. It was planned to take the place of other sulphonamides in Australia and in the armed forces, quite apart from other possible advances. The difficulties in such large-scale productions were smoothed by the cooperation of all departments and persons concerned. Occasionally problems were solved in unexpected ways: thus Colonel J. E. Down, the Dental Equipment Officer of the committee, dealt with minute flaws in some enamel vessels by inserting gold dental fillings.

Vitamin products were examined also for local manufacture. Only vitamins *A* and *C* (ascorbic acid) could be made in Australia, but adequate supplies of vitamin *A* were produced from livers of snapper and sharks, and vitamin *C* was made by the Colonial Sugar Refining Company. Wheat germ containing vitamin *B* was produced in good quantity. Important work was carried out on some antiseptics. Dr A. Albert's work on the acridines enabled him to evolve methods for producing proflavine, of which there was an exportable surplus, and new members of the series, such as 5-amino acridine. Mercurial diuretics and antiseptics were also made, and in addition, dextrose and phenolphthalein. The introduction of dimethyl phthalate as an insect repellent made its manufacture necessary: this was accomplished through the efforts of Ross, with assistance of the Surgical Instruments Panel and the Department of Munitions.

Certain vegetable drugs were now being produced in useful quantities. During 1943, both hyoscine and atropine were produced in quantities sufficient for an exportable surplus. Further planned research on this and other drugs was proceeding. Homatropine was now also made from *duboisia,* and morphine from Australian-grown opium poppies. The C.S.I.R.[2] arranged for planting enough poppies for a large yield of

[2] C.S.I.R.O. (Commonwealth Scientific and Industrial Research Organisation) was at this time known by its original name, C.S.I.R. (Council for Scientific and Industrial Research).

morphine sulphate during the next year. A method of extracting morphia direct from poppy hay was devised by a commercial firm which, with government assistance, was prepared to manufacture it without profit. Ergot was being produced in Victoria under subsidy, and all local requirements for *digitalis* could now be met from locally grown foxglove.

Manufacture of surgical instruments was proceeding satisfactorily. The manpower authorities helped by securing skilled workmen, and by allowing firms to declare "a protected undertaking" and to train young operatives. The Department of Munitions supplied machine tools and metals, and standardisation of instruments lightened the task. By 1943, 200,000 drop-forgings had been successfully produced by the Newport workshops of the Victorian Railways. The making of hypodermic syringes was simplified by the production of suitable glass tubing, and the discovery of a skilled craftsman with European experience in the work. Unfortunately fire destroyed the factory, but this setback was overcome, and, by the end of 1943, production, which had risen to 850 syringes a week, seemed likely to attain the same figure again. Enough stocks of rubber were now held to meet requirements for two years. Adhesive strapping was still controlled, as both rubber and cloth backing were scarce. A gelatine company produced a special glue, which, when painted over cotton bandages, was effective for certain purposes.

Dental, radiological and laboratory equipment was increased in amount, but there were still shortages, particularly in imported items. Essential dental requirements were still greatly in demand, largely owing to the higher standards of dental fitness demanded by the Services than that common in the civil community. Numbers of X-ray items were still imported, such as tubes and rectifying valves. Microscopes were very scarce, but a supply was obtained through lend-lease. Optical material was very scarce, including spectacle lenses, but the optical industry, developed in conjunction with munitions requirements, was expanding and production of lens blanks was expected soon. It should be mentioned that anticipation of demand played an important part in production of special material. For example, the synthesis of sulphaguanidine began in 1941, long before the acute need arose in New Guinea, and similarly, ascorbic acid, in demand for supplementing the diet of troops was made in 1940. The timely purchase of two tons of agar from Japan, the sole pre-war source of supply, just before the extension of war to the East, was also a fortunate move. For future bacteriological needs local production of agar was fostered by the M.E.C.C. and the C.S.I.R.

PENICILLIN PRODUCTION IN AUSTRALIA

A significant step was taken when the decision was made to produce penicillin in Australia. The Chairman of the M.E.C.C. took the first steps, and discussed production with the D.G.M.S. and his staff. Very limited amounts were being produced in England and America, but representations were made to General Blamey, following which the Minister for

the Army authorised the despatch of two army officers to America to study technical methods. After consultation with Major-General Burston and Professor E. Ashby, Chief Scientific Liaison Officer, Sir Alan Newton approached the Institute for Medical and Veterinary Research in Adelaide, where some research had been carried out on moulds analogous to *Penicillium*. The original plan was that it should be undertaken in Adelaide, but Dr Cumpston, Director-General of Health, was strongly in favour of production being carried out in the Commonwealth Serum Laboratories in Melbourne. This was agreed and production was expected after the expiry of a year.

In October 1943 Captain P. L. Bazeley and Lieutenant H. H. Kretchmar went to the United States of America, where full cooperation was given by the firms and laboratories there engaged in production. The great difficulties of manufacture had been largely overcome by that time, and several alternative processes were in use, producing an increasing yield of penicillin. After six weeks of intensive investigation these officers selected the most valuable features of the current methods, and through the help of the Australian Military Mission in Washington obtained top priority from the United States Government for the necessary equipment.

The delegation arrived back in Australia early in December 1943 and, with the energetic help of the Director of the Commonwealth Serum Laboratories, began work at once on the installation. Measures for obtaining glassware had already been taken, and temporary buildings were erected and equipment designed and manufactured. The scientific and technical staffs were soon trained in the intricacies of production of a pure and potent penicillin, and large amounts were actually being produced within six weeks. All departments and industrial firms concerned responded to the need for speed, with the gratifying result that Australia was the first country to make enough penicillin to satisfy all service requirements, and to provide for the needs of the civil community. Local supplies were available to the army in March 1944, and in May the same year to civilians. The credit was chiefly due to the team led by Bazeley, which studied production methods in the United States of America, and to the staff of the Commonwealth Serum Laboratories. The earliest preparations used were the sodium salt, and the "crude" and "refined" varieties of the calcium salt. A good deal of extemporisation was necessary, and, though the facilities at the Laboratories were quite adequate, the project was housed in modest basement quarters. The product was most satisfactory and gave excellent clinical results.

At the end of July 1944 arrangements were made for Sir Howard Florey to visit Australia. Blamey made a strong recommendation to the Prime Minister that Florey be invited to come and this was done. Florey gave lectures in all large centres and visited units in the field. This visit was most stimulating and helpful, and did much to further knowledge of antibiotic therapy in the Services and the civil medical profession.

The production of vitamin A oils from sharks' livers has been mentioned: it attained importance in the last years of the war, as Australia

could then meet all local demands and in addition, export large quantities for the enrichment of margarine in Burma. The establishment of numbers of factories for the manufacture of medical supplies created a demand for machinery used in commercial processes. Machines for tabletting, mixing and filling containers and ampoules for pharmaceutical processes had to be supplied.

The total expansion of production in the trades concerned in medical equipment was estimated to exceed by 60 per cent that which occurred in the year before the war. In addition to these larger projects, many small articles were successfully made in "one-man factories". From the large ventures of mass production and the wide sweep of lend-lease and other importation, to the growing of drug producing plants and the small-scale output of workshops and laboratories, the machine ran smoothly in the later war years.

A little more may be said about exports. New Zealand was a special case. In a less favourable position than Australia, and without having taken early action to build up reserves, this Dominion looked to Australia for some assistance. After an appeal by the New Zealand Director-General of Health in July 1942, the Chairman of the M.E.C.C. agreed to do everything possible to help, provided an official assurance was given that supplies were urgently needed, and that the position in Australia warranted action. The committee regarded all British possessions in the Pacific as dependent upon Australia for essential medical supplies, and such supplies were allocated to these people without restriction, except when the material desired was rationed to Australian civilians. The committee took no direct part in exportation through official channels, but was always consulted before tenders were issued. Similarly, medical equipment was only transferred to the forces of the Allied nations with the committee's concurrence. Much valuable biological material, such as sera and vaccines was exported from the Commonwealth Serum Laboratories to other countries, and contributed greatly to the Allied war effort in the Pacific, but this needed no control by the committee, as the aims of the two bodies were so completely in harmony.

Though the post-war activities of the equipment control committee do not fall within the time range of this history, a word may be said about the work done in disposal of stores after the war. Newton resigned as chairman on 30th October 1945. Ross succeeded him, and continued the work of the committee till 30th September 1946, when he was followed in office by Lieut-Colonel K. B. Brown. The committee's activities came to an end on 31st December 1946. Many problems remained after the war. The days of shortages had not gone. Some drastic action was necessary at times to control supplies of essential therapeutic agents, such as insulin and penicillin. Huge accumulations of equipment and supplies now became surplus stock, which needed disposal, if possible on favourable terms, without embarrassing local trade or production. This colossal task was carried out successfully, and before the end of September 1946 £1,500,000 was recovered by surplus disposals.

This set the seal on the work of the Medical Equipment Control Committee. A worthy offspring of the Central Medical Coordination Committee, it made a contribution to the Australian war effort equally remarkable for its scope and efficiency as for its economy of personnel. Heavy strain fell upon the executive officers, particularly on Newton, whose ability and personality carried the work through many difficulties and anxieties.

DRUG-PRODUCING PLANTS

During the years 1943-45 further work was carried out by the C.S.I.R. on drug-producing plants; the earlier stages of these investigations have been described in Volume II, Chapters 3 and 20.

Cinchona. Seed of cinchona had been planted in New Guinea, and in 1943 the surviving trees were pruned and assayed. Professor F. H. Shaw found that the yield of the plant was 1 per cent, but that of the root and stem was 1.5 per cent. Some selected seed was obtained from an American, Lieut-Colonel Fischer, who brought some with him when he escaped from Luzon in the Philippines. The C.S.I.R. raised seedlings in Australia, to obviate losses in New Guinea, and obtained good germination. In January 1944 these were transferred to New Guinea and looked after by an expert from the Netherlands East Indies. Some plants did not survive, but though a conference of experts recommended the further cultivation of trees in New Guinea and Papua, and in Australia, in particular the Atherton Tableland, by 1945 no other definite action had been taken. Much work was done on methods of raising, planting and extracting the cinchona, *C. robusta* and *ledgeriana* being found the best, and the possibility of producing *totaquina* was explored, but by the end of the war no definite contribution to wartime needs had been made.

Ergot of Rye. Mention has been made previously of preliminary work by C.S.I.R. on the production of ergot of rye, and cultures of *Claviceps purpurea* had been inoculated in a rye crop of 200 acres in N.S.W. in 1940. The quality of the yield was good, with an alkaloid content of 0.3 to 0.4 per cent, well over the minimum British Pharmacopoeia standard of 0.2 per cent. A great deal of technical information was gleaned, and in spite of weather problems and the need for development of harvesting methods other than hand picking, ergot from this source was sold. In 1944 the Department of Supply suggested guarantee of a price, but the M.E.C.C. now found the clinical position changed. Spain and Portugal, chief sources of pre-war supply, had re-entered the field, and ergot was falling into disuse, as modern hormone therapy had largely supplanted it. Therefore no further Australian effort was warranted.

Pyrethrum. Past attempts to grow pyrethrum had been successful, but little interest was shown by growers, as the costs of harvesting were too high. In 1939 further trials were made, and two years later seed was distributed to farmers for planting. Supplies were short in 1942 and the Division of Plant Industry of C.S.I.R. was asked about growing pyrethrum and harvesting it with the help of the Women's Land Army Organisation. A trial at Armidale was unsuccessful, and as immediate action was needed

to produce a crop in 1944, the Adjutant-General ordered seed from Kenya. Further trials produced very meagre results, and Dr B. T. Dickson and Dr C. Barnard of the C.S.I.R. were consulted. Tests of Kenya seed showed only 1 per cent germination, and experimental plots were disappointing in 1943. The pyrethrin content of flowers was low, but 2,000 pounds was harvested at the end of 1944. Useful work was carried out on methods of increasing pyrethrin content, but in 1945 further planting was given up because of the availability of D.D.T. and stocks of pyrethrum from Kenya.

Opium. In September 1939, medical, scientific and industrial representatives conferred on essential drugs, chief of which was opium. The Plant Industry Division of the C.S.I.R. was asked to investigate the position concerning cultivation of *Papaver somniferum* and other plants, and collected samples for analysis in university departments in Sydney and Melbourne. Opium came chiefly from the Balkans, but India started production again and began to supply the Allies. Australian supplies were very short and until the position eased, only three months' stock was held in Australia. To fulfil demands by cultivation it was necessary for 450 acres of poppies to be grown each year. One serious difficulty lay in the prohibitive cost in Australia of incising and draining latex from the capsules; some less primitive method was needed. During 1940 and 1941 seeds of *P. somniferum* from India, England and France were grown, and efforts were made to extract alkaloids from poppy juice, not from opium. Felton, Grimwade and Duerdins Ltd made a pilot plant for extraction by an improved method from the poppies grown on Mr W. R. Grimwade's farm and at the C.S.I.R.'s experimental areas. Reasonable yields were obtained, but methods of assay of raw poppy were receiving close attention by Mr H. Finnemore of Sydney University, as there was some reason to doubt the accuracy of some assays. Trial showed reasonable yields. In the year 1941-42 an area of about 75 acres was sown, much below the desired figure of 500 acres, which was disappointing, since morphine stocks had been reduced by one-half during the year. Unfortunately too, there were inordinate delays in obtaining approval for these trials, which were also set back by destruction of some of the crop by frost. However, by 1942-43 the Equipment Control Committee had a stock of one and a half to two years' supply of morphine and the position was less pressing; still, growers were encouraged, and 97 acres were planted. Attempts were made to extract from the straw, but these were not a success, quite apart from the drawback that the straw carried much less morphine than the capsules. Plans were made for a factory for the extraction of morphine, and assay showed that no loss of morphine occurred in material awaiting processing, which at the end of the year totalled 31,380 pounds. The next year poppies were grown in internment camps at Hay and Loveday, but crops were decreased by bad weather and pests, and the delayed factory, now not to be ready till the end of 1943, was only expected to produce 2,260 ounces of morphine. In 1944 a yield of 3,000 ounces was in sight, and the factory was producing

twenty ounces per ton of the whole plant. Two disappointments were encountered; most of the 1943-44 crop was found to be worthless, and the colorometric method of analysis hitherto used was found untrustworthy by Finnemore. Further dry weather caused poor yields in 1944-45, and in 1945 these arrangements for producing morphine were discontinued as uneconomic, although work went on after the end of the war under the same supervision.

These rather frustrate attempts show how many pitfalls await the optimist in this field. Probably only the scientific advisers and the commercial producers realised how much experimental background work is necessary, in order to overcome the difficulties in agriculture, extraction and analysis before a finished product is available.

FOOD AND CATERING

Questions relating to the feeding of the soldier are organisational problems which concern not only the Quartermaster-General's Department, but the other departments which have the responsibility of organising training and work in both peace and war. The medical services are concerned from the advisory point of view. The Director of Hygiene acted as the adviser of the Quartermaster-General in matters concerned with nutrition, and civilian caterers were also available for technical advice. In 1939 Lieut-Colonel C. H. Kellaway, Director of Hygiene, referred some problems in practical nutrition to Sir Stanton Hicks, Professor of Physiology and Pharmacology in the University of Adelaide, through the A.D.M.S. of the 4th Military District. Advice on subjects related to nutrition could be obtained from other sources in different commands; this varied in nature and influence, but in general the Australian Army procedure corresponded with that of the British Army.

Ration Scales. There were two peace rations, that of the Permanent Military Forces and that of the militia camps. The latter could be commuted to money value by permission of the Military Board, and expended locally to what seemed the best advantage, but Stanton Hicks in his experience regarded the result as very unsatisfactory in the feeding value of food so supplied. He was called up by his own desire with temporary rank of lieutenant, and, in addition to acting as an adviser in food and catering, began to press for the formation of an Australian Army Catering Corps.

When the Second A.I.F. came into being, the force was fed in the same unsatisfactory way as the militia in days of peace. The only personnel trained in the preparation and presentation of food were those produced by the army schools, under the aegis of the supply and transport service. Command training schools were not satisfactory, and did not remove from cooks the low degree of esteem which was, often unjustly, their portion. The system was reinforced by the engagement of civilian cooks at a raised rate of pay.

There were really several factors involved; the nutritional aspect, the correct utilisation of food without waste, and without loss of savour, in

itself a potent source of waste; the feeding habits of the people themselves from whom the volunteer forces were derived, and the need of technicians and technical advisers. It was to supply these needs that Hicks advocated the formation of a catering corps. Within this corps there would be, not units as such, except cooking schools, but specialist officers holding appointments, inspectors of catering at Army Headquarters, advisers at certain formation headquarters, instructors at cooking schools, and warrant officer caterers in major units.

A draft General Routine Order was circulated during 1943 from Hicks, who was then elevated to the rank of lieut-colonel and held the appointment of Chief Inspector of Army Catering and later that of Director of Army Catering. On 12th March 1943, G.R.O. 209 was promulgated approving the establishment of an Australian Army Catering Corps. This brief summary omits reference to the administrative difficulties and objections which had to be overcome, but it was then possible for the A.A.C.C. to come into being as an offshoot of the Supply Services of the Quartermaster-General's Branch. The Director of Catering circularised all officers of the corps and pointed out that the ideals of the organisation were those of prevention of waste of food, with all its strain on national reserves, and of physical efficiency of the fighting forces.

It was not so easy to carry out these ideals. When war was declared against Japan, the Australian Army was divided into two forces in most essentials of organisation. In its catering arrangements the A.I.F. in the Middle East was doing its best with its unchanged War Establishment to train men as cooks for its own requirements, while the fully mobilised A.M.F. in Australia had only half its establishment for cooks. Another important matter taken up by the Director of Army Catering was the adoption of improved methods of cooking. This led to the investigation and successful trial of the Wiles' steam cooker. The technical considerations here concern the volume on Science and Industry[3] though the medical aspects are also very important. It is evident that a mobile cooker is in itself advantageous, but more important is the adoption of a method of cooking which does not cause spoiling or deterioration of the protective food factors, and which will preserve the flavour of food, thus minimising waste. The steam cooker was carefully tested at the School of Army Cookery at Geelong and proved to be efficient and economical.

Another matter which engaged attention was the preservation of accessory food factors in the dietary. Early in 1940 Hicks had introduced to the mainland ration the Tasmanian field pea, which, when partly germinated, was a source of ascorbic acid. Canned vegetables were found to be defective in this factor. A practical trial was carried out on a patrol force in the Kimberleys under Major G. D. Mitchell. The members obtained their ascorbic acid ration from this source without artificial supplement, and remained well and were free from skin lesions or other indisposition. A simple method of germination was evolved in which peas

[3] D. P. Mellor, *The Role of Science and Industry.*

were kept in a tin under water for twenty-four hours and then transferred to a muslin bag, the tin being scalded to prevent mould or bacterial contamination.

In medical units care was taken that catering corps personnel did not act as advisers on dietaries ordered by medical officers for patients, but the catering corps could act in an advisory capacity in matters of kitchen management.

As soon as the A.A.C.C. was formed, a liaison officer with the A.A.M.W.S. was appointed. This officer, Captain Alice Wunderly, attended to matters related to the feeding of women's services; as this involved the nursing service a useful contact was established with the feeding of ward patients. A diet supervisor was also introduced who was able to relieve the sister-in-charge of a ward of many feeding routines, but who acted under the direction of the sister. Further advances were made in the introduction of heated food trolleys in hospital wards and special stainless steel trays for receiving individual meals.

Major N. M. Gutteridge was appointed as medical liaison officer between the Medical Directorate and "Q" Branch, Nutrition. This ensured that the medical technical side was well served in questions of principle, and helped in raising the standard of knowledge of food and nutrition in all ranks.

During 1944 Hicks was temporarily released from his university and part-time army duties by consent of the Government, so that he might undertake a confidential mission to the United States of America in a civilian and scientific capacity. The Government felt that the experience of the Director of Army Catering would be of great assistance in discussing questions relating to food supplies to the Allied troops, particularly with regard to the full utilisation of food without waste. In the tropical zones this matter assumed great importance, since loss of essential food factors could reduce effectiveness of the fighting forces. Scientific catering had brought about economies with considerable success in the Australian forces, and it was hoped that Hicks could enlist the help of food scientists in the United States in the cause of food conservation. This mission could be best undertaken by a civilian scientist, as the subject concerned the scientific aspect of the national supplies of food for the whole community: it was carried out with success. Hicks' scientific colleagues in the United States of America were entirely in favour of uniting in an effort to minimise waste of food, particularly that transported to operational areas. In October the Australian Minister for the Army informed the Quartermaster-General that this mission had been very successful, and asked for full cooperation with the American authorities. The Australian Legation in Washington was informed that a high ranking officer was proceeding to South-West Pacific operational areas to investigate the reform of food utilisation in the American theatres of war. All information relating to the organisation of the Australian Army Catering Corps was freely available to the American authorities, and aroused great interest. Full cooperation was sought with the United States catering services then

in progress of formation, and was of course freely given by the Australian Army authorities in the United Kingdom and Canada.

The influence of the Australian Army Catering Corps undoubtedly spread widely, and the principles involved were important, as they ensured adequate energy for severe exertion, replacement of wear and tear, and sufficiency of protective food factors, with enough margin to allow for deficient ingestion or absorption. The A.M.F. ration was compiled to supply 4,500 Calories in a diet containing all essential food items. It was found that most persons consume roughly equal parts of fat and protein by dry weight, and if this ratio is disturbed the excess of either constituent is wasted. Though protein was not regarded as *per se* an important source of energy, its quantity was of necessity taken into account in computation.

The Operational Ration. This was introduced to supply the ration necessary for subsistence when the complete army ration could not be supplied because of military or physical conditions. An operational ration must fulfil certain requirements, and it is necessary that the soldiers understand these. Some of these conditions are as follows. All dietary elements must be present to satisfy hunger and the calls of nutrition, so as to present a balanced ration. It must withstand heat, and not deteriorate during storage. No cooking must be needed. Flavour must be maintained, e.g. there must be no rancid change in fat. Sterilisation must kill all eggs of moths or weevils. It must be in a container easy to open but strong enough to withstand air-dropping. Packs must be water-proof. Design must meet the current size and shape, and certain items can only be made by machinery. Enquiry proved that there was a general demand for sweet components of the ration, but it is curious that criticism of this feature was not uncommon in spite of the previously expressed desire of the troops.

"Operational Ration 02" (Table 5) was tried by the 7th and 9th Divisions with distinct success, but circumstances did not permit it to be tried in the field at the outset. The contents were divided into three separate meals each wrapped in a water-proof carton in one tin which could be opened with an attached opener. The calorific value was determined by analysis, and the vitamin content by standard physical and chemical methods.

Bread. Much attention was given to bread and baking. At the end of 1941 a decision was made to supply troops with "high extraction flour" with equal quantities of white flour added for baking. The object of investigation was to increase the vitamin *B1* content of flour. Close touch was kept with the work done in Canada in producing a high vitamin white flour. The subject is too technical for detailed treatment here, but is important, particularly as the question of wholemeal bread for civilians is involved.

An interesting experiment was carried out in starting field bakeries in the Ramu Valley. These were controlled and managed entirely by cooks, and the organisation was carried out by the Catering Corps. Warrant Officer A. T. Purdie described the set up of these bakeries. He found that

bread was on issue only once a week, and though it became mouldy at the end of the week the troops still ate it. Ovens were made from 44-gallon drums, and extemporisations were employed to provide trays and other utensils. One great difficulty was fuel, as most of this was water-logged, and all of it had to be dried, chiefly with the help of packing cases from the D.I.D. The brigade headquarters helped greatly and set natives to the task of supplying wood. In spite of difficulties, other and improved bakeries were set up and from three ovens built together 725 rolls were produced, 1,450 per two hours. Salt ration tablets were given to the men to counteract the effect of salt loss in sweat. The troops were now regarding the Catering Corps as of major importance, and the cooks realised the degree of help given them by the corps organisation, and the value of their own work.

A number of surveys were made of nutrition in troops, some while under training, others while engaged in operational areas. These enquiries were related to the rations available at the time of the survey, and in addition, information was obtained concerning nutritional planning and the food patterns characteristic of the troops for whom a correct, compatible and well-presented ration was essential.

Survey of the 7th Division. The nutritional surveys carried out on the 7th and 9th Divisions in New Guinea at the end of 1943 and the beginning of 1944 are of interest. They were carried out by Lieutenant H. E. Young in the capacity of a field research officer in nutrition attached to the Medical Directorate, Land Headquarters; the observations on which they were based were made during an inspection of divisional units by Lieutenant W. H. M. Schultze, catering adviser.

This inspection showed that some dehydrated vegetables (e.g. carrots and onions) were very satisfactory, but canned cabbage was unacceptable. Blue boiler peas were often eaten raw, though water difficulties occasionally gave trouble with germination. Bread was good, and after some explanation the correct addition of 6 per cent wheat germ to the flour was adopted. Both field bakeries and improved brigade bakeries produced good rolls and bread. Three rolls daily were issued to all men in forward units. Dried milk powder was preferred to condensed milk, which was chiefly useful in forward areas where the powder gave difficulty in preparation. Tea, sugar, fruit juices and salt were well supplied. There was a demand for chocolate fortified with vitamin *D*. Extra ascorbic acid was in restricted supply and was not a regular issue. The forward operational ration was extensively used by most brigades of experience, others coming up from the reserve were advised of the advantages it possessed, particularly in prevention of waste.

Cooking was found to present problems. In the Ramu Valley, for example, and at high altitudes, fuel wood was usually damp, and petrol was precious; all supplies had to be flown in, and at best could only be used to kindle the wood. Native carriage was scarce, though forward troops were still able to have two hot meals brought up from company kitchens by porters.

Egg powder and baking powder were much in demand. The "tropical spread" of the ration was not really popular: margarine was more desired. In certain localities green vegetables were obtainable, as in the Mount Hagen area, but only if air transport was available.

Survey of the 9th Division. The same difficulties were observed with powdered milk as with the 7th Divisional forward units. Tea and sugar were in free supply but serious wastage of tea took place through the breaking of plywood chests. Drums or tins were a preferable package, and should be within the weight convenient for a porter; sacks as a package were also found most unsuitable for transport of rice. The men found the blue boiler peas grew moulds, owing to the moisture. The same dislike of canned cabbage was noticed here too. Butter was popular with all troops, but was difficult to obtain except when the cold stores were near at hand. Cheese was also liked and full rations were consumed. Bread from the field bakery was good, preferably in the form of rolls. Biscuits were disliked. The staple food was "bully beef", but the 53-pound case was too heavy for a one-man load. Egg powder was more popular than previously, owing to the greater resource of the cooks, but herrings and salmon were disliked as much as ever. It was stated that cases were seen branded "Australian salmon, 4th Grade, for the use of troops". Fruit juice was ample in supply and much appreciated. The forward operational ration was most successful, and in emergency three men could subsist on three rations for two days. After a few days this ration was found to be too sweet. Fortified chocolate was very popular. Tests were carried out to ascertain the ascorbic acid content of various food items; no major variation was found from the normal values.

Milk was freely supplied, the most popular being unsweetened condensed milk. Many of the cans were blown on arrival at the bargeheads or units. The powdered milk was of very good quality, but mixing and subsequent distribution caused trouble. Dehydrated foods were good, and were most popular, except pears. As with some other items in the ration, the size of the can was too large for ready distribution in small units.

The meat and vegetable ration (M & V) was generally unpopular, and had the drawback that it was unpalatable when cold. It seemed to produce satiety readily, particularly for breakfast. Fresh meat was provided to all units where this was possible: in some instances distance of carriage was an adverse factor and wastage from deterioration occurred. "Canned heat" was supplied but in insufficient amounts; one to each two men was not enough.

The Director-General of Medical Services during 1944 had a series of nutrition bulletins prepared for distribution chiefly to hospitals, camp hospitals and convalescent depots. These covered methods of presentation of food in hospitals and all essential information concerning accessory food factors. The latter bulletins dealt with these substances from the point of view of modern nutritional teaching and examined the problems arising therefrom in the compiling of a service ration. The factors dealt with in these brochures were thiamin, ascorbic acid and calcium.

A special memorandum was also prepared in September 1944 for restricted distribution, dealing with the rationing of hospital patients. Less technical was a descriptive account of the nutrition of Australians in the tropics, and for the feeding of natives in New Guinea. This plan was based on six points (1) the study of food patterns, (2) analysis of the average food consumed, (3) average selection of foods, (4) experiments in trial feeding, (5) production and distribution and (6) training of the producers of food and its consumers.

Catering and Nutrition

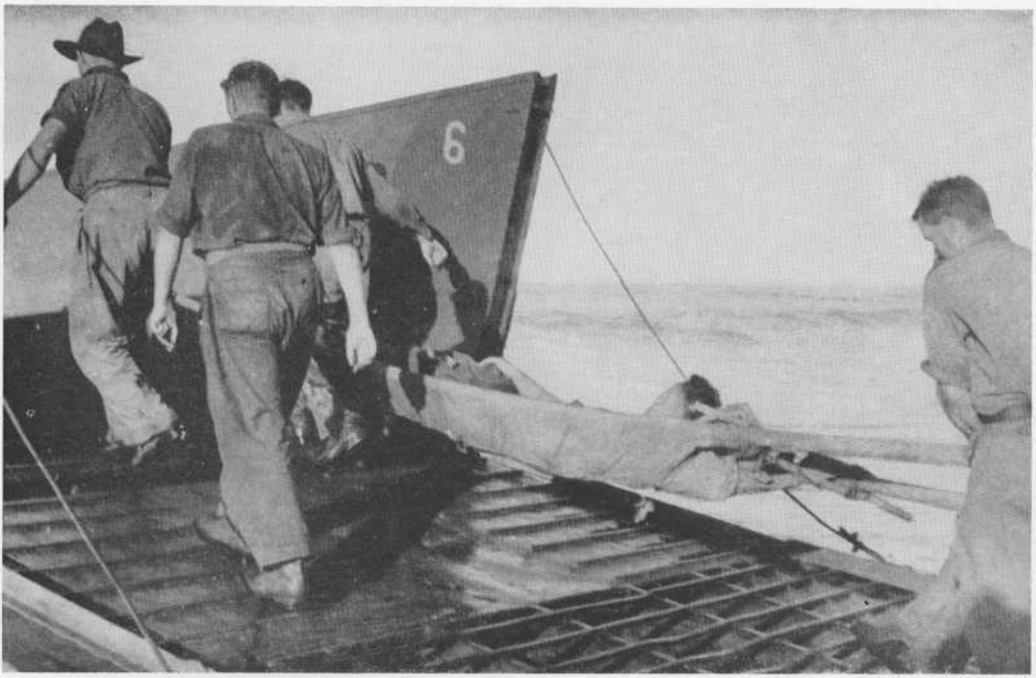
The defects in Australian food patterns should be well known to those interested in nutrition. Analysis of this pattern in 2,000 Australian soldiers showed that the average adult Australian male had a daily intake of 3,300 Calories, with a ration of 90 grammes of protein. It was deficient in calcium, iron, vitamin *A*, thiamin, riboflavin and ascorbic acid when compared with standards of the National Health Council. The army dietary problem was to make good the deficiencies without sacrificing a good caloric ration, or a high intake of protein or without interfering too much with preference and taste. Sources of ascorbic acid presented a considerable problem, as it is lacking in many domestic diets. The germination method mentioned above was only successful where enthusiasm could be maintained and a certain degree of individual skill. Lucerne was also tried as a source but without practical success.

Canned vegetables had some successes, but some failures. The same applied to dehydrated vegetables, practically unknown to the preparers and consumers of food before the war. Peas, beans, carrots and parsnips, and to a less extent tomatoes were accepted reasonably well from tins. Dehydrated cabbage, carrot, and to some extent potatoes were not successful.

Refrigeration where practicable made many individual items readily accepted; both fruit and vegetables were most welcome when refrigerated. Fruit juices were more popular as Australian troops grew used to them, and contact with the American troops increased the amount used. Naturally they were more popular when chilled.

Canned beef still held its high esteem as a source of protein, provided that the temperature was low enough to keep the fat solid. It was rather curious that rice as a substitute for potatoes was unpopular; as in the case of bread, the white variety was more acceptable than the brown. Wheatmeal was similarly not liked, but in hot climates its keeping qualities were poor, weevils attacked it readily, and the gristers originally supplied for its fresh preparation in units were found useless. Legume flour was chiefly of use in pea soup.

Butter, as previously remarked, needed refrigeration to prevent it from becoming rancid. Dehydrated butter, known as "tropical spread" was, in the opinion of the men, inferior to margarine. This was not surprising, as the spread required reconstituting with salty water. When "concentrated butter" was introduced, which contained more salt and some milk powder,



(Australian War Memorial)

Casualty being taken aboard a barge on the north coast of New Guinea for transport to a C.C.S.



(Australian War Memorial)

The 111th C.C.S., Alexishafen.



(Australian War Memorial)

A wounded infantryman being lifted on to a bush stretcher in the Tsimba area, Bougainville.



(Australian War Memorial)

Surgeons working at an improvised operating theatre on Bougainville.

it was rather more successful, but still needed reconstitution.

The above detailed observations were not always easy to integrate in a form which could be translated into action. Gutteridge, as the Medical Liaison Officer to "Q" Branch, recommended the establishment of a nutrition service which would include in its ambit the design and production of a ration scale, the distribution of rations, and the education of all concerned with food. This is a question of organisation and cannot be dealt with here, but apart from any such large-scale redistribution of advisory and executive functions, it will surely be admitted that much hard work had been put into the question of feeding the soldier, and the directorates concerned cooperated with its technical advisers in the direction of producing a better ration, more balanced and more palatable, and of transporting it to the men who needed it. Continuous enquiries were made at the receiving end, and continuous changes in material and methods were made when these were desirable and practicable. It is always necessary to remember that comparison with other rations are not always valid, as these are conditioned by the food pattern of different people.

Native Diets. The feeding of the native was a difficult and responsible task. A conference was held at Headquarters New Guinea Force in August 1943, attended by the Directors of Medicine and of Hygiene and Pathology, the acting A.D.M.S. of Angau, and the D.A.D.H. of New Guinea Force. These deliberations and subsequent reports from Angau clarified the position. The problem was twofold: the feeding of the general native population in Papua, and the feeding of the native labour force indentured through Angau to the Australian Army. The total native population involved in this instance was 750,000 excluding New Britain, New Ireland and Bougainville. Necessary war work was being carried out by some 20,000 natives.

The feeding of the whole native population was complicated by the interference with the living conditions of the natives by the war. They had been forced to leave numerous villages, for, as indentured labourers, they had been transferred from their accustomed communities to new surroundings. This badly dislocated the raising of crops and growing of vegetables, and reduced the amount of natural food available to them.

Some long-scale plans had been made, including the raising of soya bean, and processing of meal with the help of the C.S.I.R. Closer at hand were the problems of the labour force, on whose members the army relied so greatly to provide its requirements in relation to medical transport and supplies.

Brigadier Fairley pointed out that the native ration scales were closely examined, and that New Guinea Force had laid down in orders a ration adequate in calories and in vitamin *B* content. However, the scale was low in fat for native requirements. The natives were fond of fat, and consumed it freely if it was available; well marked improvement in their physical condition was evident when the fat ration was increased, though this did not apply to vegetable fats such as those derived from peanuts or maize.

The animal fats were much more valuable, but needed reinforcement with vitamins *A* and *D*, as in standard margarine. It was impracticable to give them vitamin concentrates, as these were too scarce. The quantity of fat suggested was two and a half ounces per native per day: this could be supplied in large packs, as the working parties varied in size from 50 to 150.

The supply of vitamin *B* was also discussed. Brigadier Furnell, D.D.M.S. of New Guinea Force, stated that the supply of concentrate such as "Marmite" was unjustified, as it seemed illogical to remove vitamin *B1* from rice by polishing, and return it as "Marmite". The ideal prevention of beriberi was surely by whole wheatmeal, though this presented some technical problems. A further difficulty lay in the dislike of the natives for unpolished rice. The D.D.M.S. recommended a maximum scale of food available till tomato juice, margarine, cod liver oil and dripping were to hand. Scales of rations suitable for light and heavy labour were drawn up. Further consideration was given to these subjects in another

Table 1

DAILY RATION SCALE FOR A.I.F.

(Basis of shipments Middle East)

Commodity	Scale in Ounces
Bread	16
or biscuit once weekly	12
Frozen meat	16
or preserved meat once weekly	10-1/2
Fresh vegetables	16
or peas or beans or lentils once weekly	4
Potatoes	12
Onions	3
Bacon	2
Cheese	1-1/7
Butter	2
Tea	3/4
Sugar	4
Milk	2-1/2
Salt	1/2
Jam or marmalade or golden syrup	2
Meat loaf once weekly	4
Salmon twice weekly	3
Herrings twice weekly	3
Pepper	1/100
Mustard	1/100
or curry powder once weekly	1/6
Flour or rice or oatmeal	2
Dried fruits	1

(In addition to the above scale, 1½d per man per day may be expended by units to provide extra perishable items of foodstuffs.)

On medical advice, a weekly issue of 16 ounces fresh oranges or 12 ounces of fruit juices containing anti-scorbutic elements may be made.

Table 2

A.I.F. RATION SCALE—MIDDLE EAST

	Ounces	Equivalents	Ounces
Bread	16	Biscuits	11-1/2
Meat, frozen (with bone)	14		
or fresh, local (with bone)	16-4/5	Meat, preserved	11
or boneless	9	with pickles	2/7
plus fat cooking	1-1/2	or chutney	1/14
Vegetables, fresh	16	Vegetables, preserved	6-2/3
		Comprising—Vegetables	
		tinned	2-2/3
		Beans, canned without pork	2-2/3
		Beans/lentils/peas dried	1-1/3
		If only beans/lentils/peas issued	2
Onions	3	Potatoes, tinned	6
Potatoes, fresh	12	and onions	2
		or onions	2-1/2
		and beans/lentils/peas	2
Bacon, tinned	2		
or Sausages, tinned	4		
Butter	2		
Cheese	1-1/7		
Dried fruits	4/7		
Tea	3/4		
Sugar	4		
Salt (3/4 ounce for troops in Western Desert only)	1/2		
Jam or marmalade	2		
or golden syrup	1-1/3		
Milk, tinned	2	Milk, fresh	5
Pepper	1/100	Milk ex U.S.A.	2-1/2
Mustard or curry powder	1/100		
Meat loaf	4/7	Meat, preserved (to be issued only when stocks of meat loaf are exhausted)	10/21
Salmon	6/7		
Herrings	6/7		
or Sardines, pilchards, tinned	3/7		
Flour, rice or oatmeal	2		
Fruit, fresh (when available)	4		
or 1 Orange (in season) and/or ½ grapefruit, whichever is the greater.	3 (8 men to bottle)		
Ascorbic acid tablets	1 tablet (0.025 gramme)		
Marmite	3/28		
Plus 6-1/4 mils per day per man			

Table 3

FIELD SERVICE RATION SCALE—MIDDLE EAST—Amended to 6/8/1942.

BASIS OF FEEDING A.I.F. IN OPERATIONS

Rations	Ounces	Ration Equivalents—to be issued when Fresh Rations are not available, or under special GHQ instns.	Ounces
1. Bacon, MC	3	} or Eggs (2) up to 5 issues/week	
or bacon, tinned	2		
or sausages, tinned	4		
2. Beans/lentils/peas, dried	1		
3. Bread (or flour 9)	12	Biscuits, Service	9
4. Cheese	3/4		
5. Curry powder or baking powder	1/30		
6. Fruit, dried	1		
7. Fruit, fresh, when available	4		
8. Herrings, tinned	4/7		
or salmon	3/7		
or sardines, tinned	2/7		
9. Jam or marmalade, local	2		
or golden syrup	1		
10. Margarine (note)	1-1/2		
11. Meat, frozen, with bone	8	Meat, preserved	6
or meat, fresh, local with bone	10	with pickles	2/7
or meat, boneless	6	or chutney	1/14
and fat, cooking	1		
12. Meat, preserved	1/2		
13. Milk, tinned	2	Milk, fresh	5
14. Mustard	1/100	Milk ex U.S.A.	2-1/2
15. Oatmeal	1-1/2		
or flour	2		
16. Onions	2		
17. Pepper	1/100		
18. Potatoes, fresh	12	Potatoes, tinned	6
Oil, cooking	5/7	and rice	2
19. Rice	1	or onions	2
20. Salt	1/2	and rice	2-1/2
21. Sugar	3		
22. Tea	1/2		
23. Vegetables, fresh	8	Vegetables, preserved comprising vegetables, tinned	3-1/3
			2-2/3
		Beans/lentils/peas dried	2/3
		If beans/lentils/peas only	2
24. Ascorbic acid tablets (0.025 gramme)	1 tablet		
25. Marmite	3/28		
26. Rum — to be tagged with issues to gallon	1/2 gill		
or cocoa	1 pt		
or tea	1 pt		
27. Tobacco			
or cigarettes, per week	2 ozs		
28. Matches, boxes per week	2		

Table 4

NEW GUINEA RATION SCALE FOR COMBINED FORCES
A.M.F. SCALE

Commodity Effective 4th April 1943	Scale
BEVERAGES	Ounces
Coffee	1/5
Tea	5/16
CEREALS	
Bread	12
Flour	2
Rice	1/2
Wheatmeal	1
CONDIMENTS	
Mustard	1/100
Pepper	1/100
Powder, curry	1/50
Salt	1/2
FATS	
Butter (tinned)	1-3/4
Lard	1/2
FRUIT	
Dried	2
Fresh	4
MEAT	
Bacon	6/7
Cheese	6/7
Ham or fish	1-5/7
Fresh	13-5/7
MILK	
Condensed, sweet	2-1/2
RISINGS	
Powder, baking	1/25
SUGARS	
Jam or marmalade or golden syrup	2
Sugar	3-1/4
VEGETABLES, FRESH	
Fresh	12
Peas, blue	2/7
VEGETABLES, DEHYDRATED	
Onions	1/2
Potatoes	2
SUNDRY ITEMS	
Cake, fruit	3/7
Essence, flavouring	1/350
Juices, fruit or tomato	2
Powder, custard	1/8
Sauce, tomato	1/4
Spice, mixed	1/350
Tomato puree	3/7

Table 5

OPERATIONAL RATION
TYPE O2

	Total net weight not less than
	Ounces
MEAL 1	
Biscuits, carrot	3
Fruit and cereal block (type 1 or 2)	3-3/8
Meat component	4
Peanut butter	1-1/2
Barley sugar rolls	1
Caramel bar	1/2
Sugar tablets (2)	2/5
Tea leaf	1/12
Skim milk powder	1/4
Salt tablets (2)	1/16
Wooden spoon (1)	
MEAL 2	
Biscuits, wholemeal	2-1/4
Wheat lunch	3
Meat component	4
Cheese	1-1/4
Barley sugar rolls	1
Lime tablets	1/2
Sugar tablets (2)	2/5
Tea leaf	1/12
Skim milk powder	1/4
Salt tablets (2)	1/16
Wooden spoon (1)	
MEAL 3	
Biscuits, wholemeal	2-1/4
Chocolate block	3
Meat and vegetable component	4
Blackcurrant spread (or other approved spread)	1-7/8
Barley sugar rolls	1
Caramel bar	1/2
Sugar tablets (2)	2/5
Tea leaf	1/12
Skim milk powder	1/4
Salt tablets (2)	1/16
Wooden spoon (1)	
One pocket tin opener	

conference held in November 1943. Native rations showed slight deficiencies in riboflavin, vitamin *C* and vitamin *A* (4,000 units instead of 5,000). Paw paws were a good source of vitamins *A* and *C*. The need for the recognition of the greater demands of heavy exertion was important, especially in relation to diet. For example, only A-class carriers were suitable for work in a terrain like Shaggy Ridge. Lieut-Colonel J. M. Mack, A.D.M.S. Angau, pointed out that here, though the conditions were

Table 6

EMERGENCY RATION
TYPE A3

	Total average weight
	Ounces
Chocolate bars (2)	2.50
Fruit and cereal block (type 1)	2.13
Fruit and cereal block (type 2)	2.13
Prune blocks (2)	2.50
Caramel blocks (7)	1.66
Sugar tablets (4)	0.80
Tea tablets (6)	90 grains
Salt tablets (5)	75 grains

better than those on the Kokoda Trail, the climbing alone was an exacting feat. In a later report Mack stressed that most natives were subject to malaria, hookworm and dysentery, their infant mortality was high and their expectation of life relatively brief. The average diet of the native was deficient in fat and in first-class protein. At the time in question, the third quarter of 1943, sources of vitamin *A* were scarce (paw paw was probably the only one), and vitamin *C* could not be supplied in sufficient amount for the plasma concentration to reach a desirable level. There were in fact difficulties in the way of the native labour groups obtaining an ideal diet through service channels, though improvement in the ration produced improvement in physical status. It was necessary to remember, too, that the presence of endemic infections in the natives made it imperative to maintain a barrier between the white troops and natives.

Both were to some degree vulnerable, the Papuan natives to respiratory infections, the whites to malaria, dysentery, hookworm and other tropical diseases. A general instruction on these lines was promulgated by the Adjutant-General in March 1943. This directed that native troops and carriers should be accommodated in camps well away from white troop concentrations, that sick natives should be held only in native hospitals, that native orderlies should not be employed in ordinary service hospitals, that natives should be segregated from diseases such as measles, chicken pox, pneumonia and other respiratory affections, and that native troops and carriers should not overcrowd their sleeping quarters. These instructions did not directly affect questions of diet, but all matters relating to the health of the native labour force were of vital importance to Australian troops fighting in the South-West Pacific Area.

TROPICAL MEDICINE 1943-45

TRAINING

When the centre of gravity of the war effort of Australia moved to the north of the continent and to the area known as the South-West Pacific

Area, training in tropical disease became more intense and practical. Such training was incorporated in units actually within the tropics or in course of preparation for operations in New Guinea, and the resources in Australia were used to the full. The School of Public Health and Tropical Medicine at the University of Sydney undertook an important part of the education of service medical officers in tropical diseases. Special courses of training based on an abbreviated curriculum were also given to enable suitable medical officers to qualify for the university diploma. Practical training was given in a continuous series of courses for non-medical officers and others at the Land Headquarters School of Hygiene, and at the School of Jungle Training at Canungra south of Brisbane. At the Canungra jungle school tactics could be taught and practised in a formidable environment. It was no doubt dismaying to find that not only were vector mosquitoes a feature of the school's hazards, but transmission of malaria could and did occur there, and pointed a useful moral.

The Atherton Tableland became established as a centre for rehabilitation and training in Northern Queensland, and excellent hospital facilities were of value in helping to reinstate veterans from New Guinea in normal health. Valuable clinical research was carried out in the medical units, in conjunction with the laboratory and clinical research which was proceeding under admirable conditions at the research unit in Cairns. References have been made previously to the research work carried out there by a special staff under Fairley's direction. The successes gained by the armed forces in these last crucial years of the Pacific war would have been impossible had it not been for the scientific background which enabled the applications of preventive medicine to be made with accuracy and certainty.

It was also realised that instruction in preventive medicine must be made available to all ranks of the units engaged in tropical areas, and that special attention to the technical aspects of malaria control was essential. Malaria control units had been established while the A.I.F. was in the Middle East, and their scope and number was increased. During the first years of the war attempts had also been made to have entomologists appointed to the army, but with no success until Professor Ashby, a scientific adviser of the Government, represented the need to the Prime Minister, Mr John Curtin.

ENTOMOLOGY IN THE ARMY

Four entomologists were appointed during 1942, and on the advice of Fairley, Major Mackerras was appointed to control work in entomology at Army Headquarters. Additional malaria control units were established, and those already existing were used for preliminary mosquito surveys and carried out work preparatory for local control. The officers commanding these control units were chosen for their expert entomological knowledge as well as their field experiences. The other ranks were trained at the University of Queensland and in the field.

Captain F. N. Ratcliffe was made responsible for the arduous task of obtaining equipment and supply of materials needed for malaria control. At first even the names of necessary pieces of equipment had to be explained to the staffs of Ordnance and Supply and Transport organisations, but by the beginning of 1943 all the units had adequate supplies for their work. There were early difficulties in the methods of administrative control: entomologist officers thought it desirable to maintain control of technical aspects from the headquarters of the organisation, but this method was not popular with medical administrators in the field.

The influence of the recently appointed malariologists was soon felt in the field formations, where the guidance of the malaria control units passed by degrees into their hands, thereby solving many difficulties. During this period a number of changes were initiated which gradually ended the preceding phase of lack of coordination of both action and supplies, as illustrated in events of 1942 at Milne Bay.

During 1943 the technical and administrative aspects of malaria control made headway. Entomology attained the status of a directorate, with Mackerras as director and Ratcliffe as assistant director, but in the final organisation entomology was included in the Directorate of Hygiene and Pathology, which also included parasitology. A malariologist and an entomologist acted as advisers to the director of hygiene at headquarters. Mobile entomological units had been operating since 1942, each commanded by a major entomologist, and retained their original establishment.

A school of malaria control was organised with two wings, one to give basic entomological training at the University of Queensland, and the other wing at Cairns, controlled by the local malarial control unit. Final training was planned for students in the field, but complications with the headquarters organisation made this difficult to implement. The School of Public Health and Tropical Medicine completed the training with a series of short courses for medical officers, dealing with epidemiology and malaria control. A service was also established for the circulation of technical information, so that entomologists and members of malaria control units could be kept abreast of recent progress and research.

These overall plans for malarial control at first sight may have appeared to be elaborate, but were in reality simple, and set the technical side of the prophylaxis of malaria on a practical scientific basis. It had been hard to convince non-scientists of the need for field research, but the influence of these specialists was undoubtedly very valuable.

Mackerras pointed out that in New Guinea "the control of malaria in the field is primarily a matter of anopheline control or full atebrin suppression". The importance of exact knowledge of local mosquito vectors in an affected area, and of their relevant habits was proved repeatedly in later phases of the island campaigns. Biological studies permitted much greater accuracy in using "species sanitation" as a basic principle in all control. The work done fell into three categories; investigations, trials of method and material, and laboratory studies. Laboratory work was best pursued in institutions already established and well equipped. The

services were enriched by the willing cooperation of several civil institutions. The C.S.I.R. made available a section of its Division of Economic Entomology for full-time entomological investigations for the army. These facilities were controlled by Captain D. F. Waterhouse who, by virtue of a commission in the Reserve of Officers, was able to follow up the work into the field. Biological and chemical studies of control methods were carried out in this way.

In the University of Sydney Mr D. J. Lee conducted research under a Commonwealth research grant, and later worked under the direction of the Scientific Liaison Bureau. Using accommodation and equipment made available by the Department of Zoology, he provided a museum of mosquito material collected in the field, and was able to identify specimens promptly for the army malaria control units and mobile entomological sections. This material was codified and later published, thus widening the value of the work and making it of high practical value.

Dr G. A. M. Heydon of the School of Public Health and Tropical Medicine also carried out teaching work on parasitology for medical officers, and made studies of precipitins of blood samples sent from the field. Useful information was thus supplied concerning the relative degrees of importance of anopheline vectors of disease.

The mobile entomological sections were increased in numbers as their work and importance grew, and six were later appointed. In addition to the field routines which helped the malaria control units to establish themselves on a scientific basis, the entomological services played a substantial part in a number of investigations of importance to the armed forces. These may be summarised under the following headings:

Studies of repellents and development of insect repellent lotion; establishment of standards for mosquito and fly sprays and sprayers; control of scrub typhus by miticide repellent (work carried out by Major R. N. McCulloch); laboratory work at the C.S.I.R. on malaria oil and D.D.T.; development of aerial spraying by aircraft; biological studies of anophelines; systematic studies of mosquitoes by Messrs D. J. Lee and A. R. Woodhill; epidemiological studies on malaria; entomological work in connection with the research carried out in the Land Headquarters Research Unit at Cairns; and entomological work in connection with experiments on the transmission of dengue fever at the University of Sydney and Concord Military Hospital.

The work done by entomologists was outstanding in its value to the forces undertaking campaigns in country where malaria, mite-borne typhus and dengue were endemic. In the large-scale coordinated researches, in particular that carried out at the Cairns Medical Research Unit the work was unified, largely by the experience, authority and personal influence of Fairley. In the smaller projects, undertaken in the field in the disconnected intervals of routine investigations, there was often difficulty in maintaining the ideal of a detached atmosphere. Notwithstanding this, the practical value of the entomological services was proved, and they have also made contributions to knowledge.

In the light of army experience, Mackerras made suggestions for the most useful methods for employing entomological sections in forward operations. In New Guinea only one malarial vector was operative, but in other tropical countries the habits and breeding grounds of several vectors would need to be taken into account. It was therefore desirable for mobile entomological sections to accompany malaria control units in the early stages of advance. In forward operations involving a corps, three sections were needed for vector studies; for advanced bases studies of local flies and mites were advisable, and further biological data concerning mosquitoes were required.

In 1944 Mackerras was sent overseas to England and the United States to present the results of entomological research in malaria and typhus in the South-West Pacific Area, to give information regarding malaria control in the S.W.P.A., to enquire into recent developments in insecticides and repellents, and to emphasise the value of plasmoquine in the treatment of malaria and in the limitation of its spread. This visit was welcomed both in the United Kingdom and the United States of America. It illustrated the greater realisation of the value of personal contact and of the need for a scientific basis for the technical medical aspects of war in the tropics.

MALARIA EPIDEMIC IN CAIRNS

The importance of Northern Australia during a war in the Pacific concerned both military and medical conditions. In the tropical areas malarial transmission could occur; hence the great value of a non-malarious tract of country on the Atherton Tableland, where troops could safely be sent for training and rehabilitation. There were, however, areas in Northern Australia which caused anxiety. One of these was Cairns, the only area in the settled parts of Australia where epidemics of malaria occurred. Late in 1942 a sharp epidemic of benign tertian fever called for action, as there were troops in the area. Control was promptly undertaken, and as the dry season advanced, energetic measures caused the outbreak to wane. The problem was a wider one than that of an outbreak of *vivax* malaria among the civil population, though Sir Raphael Cilento, Director-General of Health in Queensland, had pointed out that the epidemic was extensive: in four months 500 cases were recorded, 50 of these being among service personnel. An account of this epidemic and the measures adopted has been given in *Clinical Problems of War,* Volume I of this series, pages 77-79, but some points may be mentioned here.

The Commonwealth Director-General of Health released Dr Heydon for special work on the local vector, as this had never been determined with certainty. It was found to be *A. punctulatus,* identical with the New Guinea vector. This was most important, as control was henceforth organised on a sure basis. There were large swamps on the outskirts of Cairns, but this vector hardly bred in the swamps, but in the clearer waters in other parts, and did not flourish south of Ingham. Army control units carried out preventive work and *Gambusia* fish were introduced into the swamps, and possible carriers of *falciparum* gametocytes were removed to a safe

environment at Atherton for treatment. With the cooperation of the United States Armed Services, the Australian Army, the Cairns City Council, and financial assistance by the Queensland Government a drainage scheme was carried out. A National Security Regulation gave the D.G.M.S. of the A.M.F. the power to examine civilians in defined areas and if necessary to treat them if infected. No Australian troops were allowed to stay in Cairns. These measures controlled the situation; it was recognised that though Cairns was officially proclaimed as "potentially malarious" it was really malarious in fact, and the risk of introducing malignant malaria to the mainland of Australia might have been serious, especially if contact of carriers and vectors was not prevented. The timely action taken to deal with this local epidemic of benign tertian malaria no doubt was of great prophylactic importance, and prevented the obvious dangers of introducing malignant tertian malaria to Australian battle stations within the 19th degree south latitude, a line which included Cairns but not Townsville.

CONDITIONS IN THE NORTHERN TERRITORY

Consideration of the risks of malarial epidemics arising in Cairns emphasised the greater risks of such outbreaks in the Northern Territory. This great tract of country was a potential buffer at the north of the Australian mainland, and an important defence area. The Commonwealth Department of Health had always been alive to the significance of the Northern Territory in the maintenance of health of Australia, particularly with regard to endemic or introduced infectious disease, in particular malaria. Colonel M. J. Holmes had studied this carefully and had valuable records of the occurrence of malaria among the aboriginal inhabitants. From the medical aspect, the Northern Territory was of great interest and importance, viewed as a defence area, and we may briefly refer to the problems encountered there.

Here was a vast expanse of country, much of it harsh and sparsely settled, some of it empty of habitation over great distances. Motor transport was possible over most roads, though some were very rough. War requirements produced more roads, in particular a good north-south road by which most of the army transport travelled. Rail transport was limited to the railway which ran from Darwin through Pine Creek, Adelaide River and Katherine to Birdum. The chief medical installations were sited along this line from Darwin to Katherine, and it was used for the carriage of some supplies and the transport of sick by ambulance train.

There were numbers of landing strips near the more settled areas, and well-developed airfields in a few larger centres. These could meet military and civil requirements, and Darwin had a well-equipped airport. A very satisfactory method of air evacuation was in operation there; a Dakota plane was equipped with webbing supports for stretchers, and could carry twenty-four patients in comfort.

The climatic year was roughly divided into dry and wet seasons. Rainfall was chiefly seasonal, the rains falling mostly over a well-defined wet

season during the period January to March. The dry season was hot and dusty, but save for the discomfort of glare and dust gave rise to no special medical problems. Agricultural activities were carried on with success: the supply and transport services directed farms from which the army was supplied with vegetables from a cultivated area of some hundreds of acres. In some areas the growth of grass was remarkable, even reaching a height of eight to ten feet. Severe thunderstorms were experienced at times, and lightning struck trees and telegraph wires, and even the ironstone ridges. One death occurred from this cause. These violent manifestations of nature were only occasional, and mostly seasonal.

The wet season brought risks of flooding in some parts; heavy falls often flooded rivers and blocked transport, and on occasion caused considerable difficulties in hospital areas. Early in 1944 heavy downfalls caused a rise of fifty feet in the Adelaide River, and flooded the 119th A.G.H. in that area. Flood waters rose to within a few inches of the wards, and disorganisation of the pumping machinery caused failure of the water supply. Patients were promptly removed by train and returned a fortnight later. The Katherine area was also low-lying in parts and the 121st A.G.H. site was subject to flooding after heavy falls. This season also caused considerable physical discomfort by its extreme humidity and greatly increased insect breeding. Minor lesions were frequent on the skin, and readily became infected. *Miliaria rubra* was very common and was often followed by troublesome dermatological sequels. These were the subject of some valuable research by members of the A.A.M.C. Indolent ulcers sometimes appeared on irritable or exposed areas, and needed careful treatment.

Care was taken to provide an adequate dietary, and the standard of rations was satisfactory, though a degree of monotony was difficult to overcome.

During the latter war period the Northern Territory acquired an unenviable reputation as a begetter of various physical and mental troubles among members of the defence force. It must be realised that the period under review was relatively remote from the time and circumstances of the enemy raid on Darwin in February 1942. There was no reason to think that any disturbances of morale noted during that earlier period had persisted as a military background. The defence forces in the Territory had extended greatly, and were well officered and organised. Nevertheless there were independent factors at work in the forces during the period they were stationed in the Northern Territory which were not productive of content among the men.

Monotony and relative lack of amenities and entertainment fostered a certain degree of depression, which was sometimes in evidence among men who had suffered mild forms of endemic disease. Many of the men were distant from their homes and this distance, combined with the impracticability of leave was prominent in their minds. It must be pointed out, however, that similar sundering by distance was present in the Middle East, without appearing as an important cause of lowering of

morale. The instances are, of course, not parallel, for the men in the Territory had no defined objective before them, and few had opportunity to engage in such campaigns as were leading to victories against the Japanese forces in New Guinea.

Colonel N. D. Barton, D.D.M.S. of Northern Territory Force, noted that increased numbers of men complained of minor discomforts for which they often consulted specialists. These complaints showed a pattern characteristic of functional conditions; for instance, eye symptoms were a frequent cause for complaint, though relevant organic states were seldom discovered. Glare and dust undoubtedly caused symptoms in some, but not to a degree greater than was common even in more troublesome climates. All consultants noted that, irrespective of their specialties, certain complaints made by the men were practically constant, especially the local climatic conditions. Mild psychological disturbances were common, particularly in men who were not occupied in duties which appealed to them as productive or intrinsically of value.

Colonel D. M. Salter, when D.D.M.S., considered that some men were kept over-long in a dull environment in which there seemed little prospect of change. Change, he pointed out, was important, and was a necessary part of rehabilitation, which also required forms of occupation of a purposive kind, other than routine duties. Such occupation was largely lacking, and in small units particularly this was a serious drawback to the maintenance of morale. It can be understood that many men felt that the watch-dog function of the Northern Territory Force was not conducive of interest in duties which seemed to them to bear little obvious connection with national defence. Yet this is not all that may be said on the appearance of what was undoubtedly a mild anxiety state or psychoneurosis.

Since the end of the 1939-45 war more light has been shed on "tropical fatigue" as an entity. Research has laid some stress on the importance of the discomforts of the tropics as a physical component of the fatigue which manifests itself as a lowered output of energy, interruption of a normal sleep rhythm, diminished appetite, and some degree of physical deterioration. Men exposed to undue heat over a long period may show such signs, and suffer from various localised discomforts which may interfere with work and sleep. Lack of sleep is surely important. A curious feature of "tropical fatigue" is its potential reversibility. Effort can help to reverse the existing effects of fatigue; such effort may even require fortitude, and may be called forth by an emergency or a real and sustained need. Removal to a cooler climate, as is well known, may likewise produce a favourable change in the physical condition. It is important to recognise both a physical and a psychological factor in this condition, and to see the need for a judicial approach. It is interesting though not unexpected that service women seldom made complaint. The connection with morale is also significant. The term "tropical neurasthenia" was sometimes applied to this state, but this was not a happy name, for sojourn in the tropics is not of necessity the only causal factor, and it is inadvis-

able to use a name which assumes that this environment is necessarily inimical to health.

Malaria

Much more important was the problem of malaria in the Northern Territory. The native inhabitants, living chiefly along the lower reaches of the principal rivers, were subject to a low grade of malaria of endemic type. In the areas where settlers congregated the danger of the outbreaks was real, especially when a carrier of M.T. was introduced, and considerable epidemics of definite severity had occurred from time to time. These outbreaks tended to be self-limited and to vanish with the onset of the dry season, commonly re-appearing in the next year, but only if conditions ripe for transmission were reproduced in the meantime.

The danger of attack by the Japanese from the north was hard to estimate, but there was no doubt that the difficulties in maintaining an effective defence force would be greatly enhanced if malaria was free to spread and so to destroy the capacity of susceptible troops. Therefore it was essential that the anopheline population of the Territory should be controlled at least in its areas of greatest potential concentration. The prevention of malaria was successfully carried out in an effective if unorthodox manner. The troops of the Northern Territory Force were mostly in the more dangerous areas from the point of view of malarial propagation, but the stationing of several malaria control units at strategic points provided a striking force that could be brought into action at any time when a local outbreak threatened. All natives were segregated; refugees arriving from malarious countries from the northern islands were also segregated and removed, and special measures were taken to control other possible carriers. A routine order prohibited and prevented service personnel coming from endemic areas from entering the Territory, and when key personnel made short-term visits to the area, special care was taken that adequate suppression was ensured. A very careful check was kept on the identity and movements of persons who might be in the Territory without warrant.

During the last three years of the war very few indigenous attacks of malaria were observed. It was a remarkable exposition of preventive medicine to keep the Northern Territory free from epidemic malaria during a period when there was a high concentration of troops. The dearth of mosquitoes capable of transmission had a curious result, that the entomologists were unable to discover the identity of the vector responsible for the last epidemic.

The care bestowed on malaria prevention was rewarded by a low incidence of dengue fever also, and its figures dropped to a very low level. This was due in part to the war on vectors, but the development of immunity in the force probably also played some part. Control was the easier to apply because the endemic areas were Darwin and to a less extent Katherine, where control measures could be applied. Thursday Island, previously with a high infection rate, was also brought under control for dengue. The only other important endemic disease was dysen-

tery; practically all cases were of bacillary type, though occasional amoebic infections were observed. Dysentery was mildly endemic in Alice Springs, and often occurred in men who had travelled north by road. The facilities for the washing of mess gear were poor, and water was scanty along the road: improvements in arrangements lessened the infection rate. No Shiga infections were reported, the commonest type was Flexner. On the whole the health of men in the Northern Territory Force was good, and the keeping of the door shut to malaria during the war years was a notable achievement, carried out in an unusual way.

References have already been made to the researches in malaria carried out in the Army Research Unit at Cairns. Brief consideration of the contributions to scientific medicine during the Japanese war show clearly how the scientific basis for the war on tropical disease was surely established. More and more the value and importance of this work was emphasised, and the Atherton Conference on Malaria held in June 1944 showed how intimately the work and findings of the Research Unit had impressed the combatant officers who were present. The knowledge that grew concerning the processes of malaria, its suppression and treatment with drugs old and new, made the realisation of military planning possible. The impact of tropical diseases on Australia might have been much more serious had it not been for preventive medicine, and the story tells itself without further emphasis.

HYGIENE REORGANISATION[4]

The Standing Orders of the Australian Army Medical Services lay down the necessity for each military district to take steps to train all ranks in hygiene and sanitation, and under static conditions directions were given for an annual course of instruction of officers and other ranks. More important still was the inculcation of the principles and practice of hygiene in areas where active military operations are taking place. Before the outbreak of war little more was done than to ensure that officers commanding field hygiene sections gave instruction to officers of militia field ambulances.

After the outbreak of war more effort was made in some commands to hold schools, and field hygiene sections, being divisional units, gave some appropriate instruction to members of units in training. By August 1940 a permanent hygiene school was established by Headquarters Eastern Command, under direction of Major E. S. A. Meyers, the Assistant Director of Hygiene. In June 1941 the use of a large private residence in Clovelly, N.S.W., was obtained for the school, courses were arranged for thirty officers and men, and a museum of hygiene exhibits and sanitary appliances was set up there. In August 1942 the school came under control of the Allied Land Headquarters, and became the Land Headquarters School of Hygiene and Sanitation. Under command of Major Shannon

[4] This section is compiled largely from material supplied by Colonel M. J. Holmes, formerly Director of Pathology and Hygiene, and Major H. Shannon, formerly officer commanding Land Headquarters School of Hygiene.

this school did much good in helping many officers and men to a greater knowledge of hygiene in relation to a fighting force.

Many of the courses were but brief, such as induction courses, and there were difficulties in maintaining contact between a stationary base unit and work in the more or less distant field, but the school played a useful educative part in hygiene training. General training policy was decided by the Director of Military Training and the D.G.M.S., while the D.D.M.S. of the area was responsible for local administration. In 1943 steps were taken to keep the school in touch with hygiene personnel in the field, to whom medical journals were also sent to enable them to keep in touch with recent developments. Another useful activity was the holding of a ten days' course for commanders of field units. Experienced medical officers were drawn upon for the tutorial purposes of this course. More facilities were availed of at the School of Public Health and Tropical Medicine, and it was found possible to extend a combined course to six weeks, of which four were spent at Clovelly at the hygiene school, and two at the jungle warfare school at Canungra. Groups of twenty platoon and company officers were taken into Clovelly every two weeks for this course, and a comprehensive programme was thus carried out. Between October 1943 and March 1945, when the Canungra phase of the course was discontinued, some 400 officers completed this training. In June 1944 the name of the school was altered to the Land Headquarters School of Hygiene, as the emphasis on sanitation gave a wrong impression of the aims of the establishment.

Criticisms were not lacking, and were salutary, though some could hardly be obviated by the staff of the school. A preponderance of lectures was hard to avoid, and the practical application of instruction on the part of trainees was not always in evidence. This difficulty was clearly set out by an experienced medical officer as follows:

> The modern soldier is advised in lectures of the necessity of
> (a) water discipline and water sterilisation,
> (b) food protection,
> (c) wastes disposal routine,
> (d) safe excreta disposal,
> (e) control of insect vectors of disease.
>
> Yet reinforcements graded as D.P.1 still reach operational troops
> (a) completely undisciplined in field ablution and water sterilisation,
> (b) grossly negligent in food protection and wastes disposal,
> (c) given in apparently high percentage to promiscuous defaecation in the field,
> (d) with inadequate training in mosquito, fly and mite control.
>
> The hygiene training of troops for operational areas in the tropics demands the closest scrutiny of camp conditions, and it is submitted that the strictest enforcement of hygiene discipline in its smallest detail upon all ranks must be observed during the initial training. Until this is achieved, lectures and lecturettes can be nothing more than an ineffective pretence.

The influence of the school was good and widely diffused, and when the soil was prepared and the seed planted, it was the responsibility of individuals of all ranks to follow scrupulously the measures laid down in the field, so that these might bear the fruit of prevention of disease. This

question of responsibility was of great importance, and its value in producing good results in the following of hygienic rules and thus in the prevention of disease was seen again and again during the war years. Good examples were seen in the disciplinary control of hygiene during the siege of Tobruk, and in the later phases of malaria control in New Guinea. It was realised with greater clearness as time went on that action and the reason for action must be firmly linked in the soldier's mind. A serious difficulty which occurred in many schools of training was the poor standard of literacy of numbers of men sent to take part in hygiene courses. This was largely a function of the unit responsible for their choice, but it was found that as a clearer concept of the real functions of hygiene organisation became general, the standard rose. This enabled the question of individual responsibility to be more constantly before the junior leaders and officers, right up to the commanders.

Courses were arranged for the induction of junior medical officers and for regimental medical officers, but from May 1944 more systematic training of newly-joined medical officers was adopted. A five weeks' course was arranged at Darley, Victoria, followed by a two weeks' course at Clovelly in military hygiene. Up to the end of the war 160 medical officers were so trained. At this time too a three weeks' course was given to R.A.N. ratings, and this proved very useful to men who were engaged in duties in beach installations. Allied medical officers participating in courses in tropical medicine at the university school were also given some periodic instruction in methods of hygiene. In 1945 a course was conducted for assistant patrol officers for the Australian New Guinea Administrative Unit (Angau).

In 1944 and 1945 facilities were also given to a group of medical officers from the three armed Services to take a special three months' course for the Diploma in Tropical Medicine and Hygiene at the University of Sydney. This was outside the scope of the Hygiene School, but the duties of potential Deputy Assistant Directors of Hygiene were borne in mind during the course.

A Land Headquarters school of malarial control was also raised and as the wider concept of hygiene gained recognition a closer alliance between this and a hygiene school was favoured.

In the field it became more evident that instruction and supervision were necessary at all levels. To implement this, cadres were required from which schools or other forms of practical instruction could be expanded. These considerations, together with the growing importance of the mechanism of carrying practical hygiene of the soldier into daily life led to a critical examination of the system prevailing at the beginning of the war. It was evident that elaboration and improvement of the existing didactic methods of training were not sufficient, and alterations in the system were required.

The need for reorganisation of the hygiene services was further evidenced after the war when, after a War Office Standardisation Conference in London, the British Army abolished divisional field hygiene sections and

replaced them by a pool of sanitary assistants under a D.A.D.H. at divisional headquarters. Australian reorganisation went further than this scheme, but the principle remained the same.

It is significant that in the middle of 1943 when the operational strain was most severe in the S.W.P.A. and when manpower wastage was at its height, the greatest need for improved hygiene consciousness was felt.

On 20th August 1943 the D.G.M.S. pointed out to the Director of Military Training that even in the Moresby Base Area where malaria control had practically abolished anophelines from the area, half the cases of malaria were new infections, indicating a lack of intelligent cooperation by the men, and therefore a fundamental weakness in their training. In an infantry brigade in the Wau area the average weekly first attacks of malaria made up a wastage of nearly 70 per cent annually. Dysentery was almost as important as battle casualties as a waster of men.

The reports of the D.A.D.H. II Australian Corps on the hygiene training of the corps were disquieting; he described the individual hygiene practice as deplorable. In all three divisions a poor personal standard of hygiene persisted from the Middle East, where conditions of terrain and climate lessened the risks which were so much greater in the islands. In spite of the stress laid on the urgency of the problem, the efforts of the R.M.Os., and the work of schools, vacated camp sites showed how bad the hygiene standard could be. The D.G.M.S. summed up the position by saying:

> If the present lamentable state of affairs is to be improved, hygiene training must be integrated into individual training of the soldier, and must be given by platoon commanders, troop leaders and by their N.C.Os. It must be maintained throughout the training period and during service in units.

He further pointed out that formations were failing to fill their allotments to the Land Headquarters School of Hygiene.

HYGIENE IN THE FIELD

In 1939 the system was that operative during the 1914-18 war, though the unit later known as the field hygiene section was formerly called a sanitary section, a name open to serious objection, since it suggested what was indeed a fact, undue concentration on the manufacture and supervision of sanitary appliances. The field hygiene sections were divisional units, and while good work was done by these units, there were considerable limitations to their scope and performance. They were intended to be inspectional and advisory in function, but they were often diverted to carrying out constructional work or disinfection or instructing units in these activities. For this purpose they had tradesmen on the establishments. In the 1914-18 war the sanitary sections were not competent to cope with a war of rapid movement, as they were often detached from their divisions and employed in workshops in fixed areas. This tended to lower the concept of hygiene, and the same disability applied to the field hygiene sections of 1939 onwards unless their command rested with medical officers. These units were not always commanded by medical officers, but sometimes by officers with the status of health inspectors.

Holmes protested strongly against this policy without result. Expert direction and guidance could not always be obtained from the divisional medical staff, as the D.A.D.M.S. was often too busy with administrative duties, and during periods of operational stress, had too many other responsibilities to control the hygiene sections. Holmes pointed out that only about one-third of the members of a field hygiene section (twenty-eight O.Rs.) had rank or training fitting them for supervision or instruction, and the unit itself was not able to act as an adviser to the divisional command. Both the commanding officer and his few senior N.C.Os. were largely busied with administrative and clerical duties, and in practice the field hygiene section system was cumbrous and not flexible enough. It frequently broke down under the exigencies of warfare, especially in a war of movement. When a division covered a wide area, personnel of the field hygiene section had to be got together again for the move, and again dispersed when the division reached its new destination. In a war of rapid movement the field hygiene section as a divisional unit became unworkable, and in the Middle East dispersal of these sections lessened their value considerably under such conditions. In New Guinea in the early stages of operations, troops were frequently moved by brigades attached temporarily to New Guinea Force, and the field hygiene sections had only restricted opportunity to work except as area units.

In Australia it was significant that when field hygiene sections were formed, only the commanding officer and some N.C.Os. were usually called up at first, as the remaining members were not used in an advisory capacity but were dispersed to camps as these were filled. Thus these sections were not trained as units, and R.M.Os. were not encouraged to take an active interest in matters of hygiene. Instances occurred in Australia and New Guinea where a more flexible mechanism might have prevented outbreaks of infectious disease.

The field hygiene section N.C.Os. dispersed to camps in each command had too low a non-commissioned rank and status, and little attention was paid to them by camp commandants and officers commanding units. Naturally, well-qualified men such as health inspectors were not attracted to field hygiene sections, and preferred to enlist in other units. In some instances, in fact, field hygiene section N.C.Os. were employed in doing the actual sanitary and conservancy work of camps instead of supervisory and instructional work. There were too few of them in any case to supply all camps, and consequently the hygiene N.C.Os. were allotted only to the larger camps, the smaller camps getting scant attention. To increase the number of available N.C.Os. it would have been necessary to increase the number of these half-formed hygiene sections and this was not desirable.

The break-down of the field hygiene section system in the commands led to the adoption of unauthorised practices, such as the appointment to camps of hygiene N.C.Os. responsible direct to the camp commandant and not to the officer commanding the field hygiene section. In such cases the A.D. of H. in the command often found it impracticable to get any

reports from such camp hygiene N.C.Os. or to keep effectively in touch with hygiene conditions in the camps of the command.

It will be seen that both in the forces in the field and the commands in Australia there were many defects in the hygiene system, leading to ineffective operation. In the army in the field, there was inadequate machinery within units to enable each unit to bear its responsibility for its own hygiene, the fundamental consideration in any effective system. The field hygiene section system was not well adapted to give units the necessary inspection, supervision and advice for prevention and control of disease under all exigencies of service. With the projected move to put field hygiene sections under command of non-medical officers, it was obvious that these sections would become still less competent to carry out this function. Within the commands in Australia the system was still less satisfactory.

In these circumstances consideration was given to a reorganisation of the hygiene service on new lines. This plan for a reorganised hygiene service was devised and sponsored by Colonel Holmes, who was the Director of Hygiene and Pathology for the Australian Military Forces, and was in civil life a senior member of the Commonwealth Department of Health.

The principal desiderata aimed at were:

1. To strengthen unit initiative and efficiency in hygiene by providing an adequate hygiene set-up within each unit, and to enable the unit to effectively carry its responsibility for its own hygiene.
2. To enable instruction and training in the details of hygiene to be continuously carried within each unit by qualified unit personnel.
3. To give to responsible hygiene personnel adequate rank and status to enable them to carry out their duties effectively within units, and to attract to these appointments well-qualified men such as health inspectors.
4. To provide initiative, and expert direction and supervision and advice in the prevention and control of disease and maintenance of health by expert medical officers holding appointment on Army, Corps and Divisional Headquarters.

THE NEW SYSTEM

It was decided to recommend the abolition of the existing field hygiene sections and the adoption of the following system:

1. The appointment to each Army, Corps and Divisional Headquarters of a medical officer (with rank of major or higher) under the D.M.S., D.D.M.S., or A.D.M.S. respectively and with knowledge and experience in epidemiology and behaviour of diseases and the control of disease vectors. Such a medical officer is not only in a position to initiate, direct and supervise control measures and training but, by virtue of his position at headquarters, he is able to maintain touch with headquarters staffs in quartermaster-general, engineering and ordnance branches and so facilitate the availability of materials and supplies to units for hygiene work.
2. The appointment to each brigade group of one hygiene officer (lieutenant) A.A.M.C. For these appointments it was proposed to select suitably qualified persons such as science graduates or fully qualified health inspectors with training in medical entomology, epidemiology and disease transmission and control.

3. The appointment to each unit to which an R.M.O. is attached, of one hygiene staff-sergeant (A.A.M.C.). For these appointments it was proposed to select persons preferably with health inspector qualifications, and with some grounding in epidemiology and other special aspects. It was proposed that the hygiene staff-sergeant working under the R.M.O. should report also to the brigade hygiene officer, who in his turn should report to the A.D. of H.
4. The appointment to each unit without an R.M.O. of a hygiene N.C.O. (non-A.A.M.C.) of lower rank than staff-sergeant; such N.C.Os. to be under the direction and supervision of, and to report to, the brigade hygiene officer.
5. For commands (or L. of C. areas) within Australia or elsewhere, the provision on each command Headquarters of—
   (a) One medical officer A.D. of H. (rank of major or higher);
   (b) A pool of area hygiene officers A.A.M.C. (rank of lieutenant) and of warrant officers and staff-sergeants A.A.M.C. (hygiene inspectors). The number of these hygiene officers, warrant officers and staff-sergeants varied with the size of the command. They were to be under control of the A.D. of H. and to be allotted to area and camp commandants as required. In addition division, brigades, etc. under command control had, of course, with them their own allotment of hygiene officers and N.C.Os. as provided on their war establishment.

Transport. Provision was made in the new organisation for transport of hygiene officers and N.C.Os.

Disinfectors, etc. The high and low pressure steam disinfectors were placed under the control of the A.D. of H. for use as required in the division or on the command (or L. of C.) areas. It was proposed that the mobile baths also should be under control of A.D. of H.

Training. In order to provide for training of officers and N.C.Os. for hygiene appointments in armies or in Commands or L. of C. Areas, and also for refresher courses, and other aspects of training, it was recommended that in addition to existing L.H.Q. or command schools of hygiene, mobile training cadre or school should be provided on the war establishment of each corps and also in each force (N.G. Force and N.T. Force).

Corps Training Cadre. For this purpose it was proposed that a cadre of A.A.M.C. hygiene officers (2), staff sergeants (3) and hygiene tradesmen (carpenters and tinsmiths, etc.) (4) should be placed on the war establishment of each corps and force, and suitably equipped for training purposes including provision of a heavy lorry for mobility.

Adoption of New Hygiene Organisation. These various recommendations were adopted in principle and the new organisation began to come into operation about the middle of 1942. It developed by stages during subsequent months.

Advantages of New Organisation. The principal advantages of the new organisation are—

(1) It emphasises the basic principle that each unit is responsible for its own hygiene, and it provides for each unit the necessary skilled personnel to enable the unit to carry out its hygiene responsibilities under all the exigencies of service;

(2) It puts units in a position to improvise and construct necessary sanitary appliances instead of depending upon a field hygiene section to supply them and thus renders the unit self-reliant under all conditions;

(3) It is under expert medical supervision and control with expert A.A.M.C. hygiene personnel from headquarters down to individual units;

(4) It provides suitable rank, status and authority for hygiene officers and N.C.Os. thus enabling effective performance of duties;

(5) By providing for commissioned rank and high N.C.O. rank for suitably qualified non-medical personnel, it attracts the skilled type of man (such as science graduates and health inspectors) necessary for inspectional and instructional work;

(6) It places the hygiene medical officer (A.D. of H.) at headquarters where he can use his influence to most effect in his relationship with headquarters staff, both in initiating and implementing measures for prevention and control of disease and in ensuring availability of necessary materials and supplies;

(7) It provides for the D.A.D.H. a direct line of A.A.M.C. hygiene officers and N.C.Os. down to each unit thus enabling him to keep directly in touch with health aspects of each unit;

(8) It provides for direct access and report by each hygiene officer and R.M.O. etc. to D.A.D.H. Divisional Headquarters, thus permitting pressure by divisional headquarters on any C.O. who neglects his responsibility for the hygiene of his unit;

(9) It provides for training of hygiene officers and N.C.Os. and for continuous instruction of pioneer hygiene and water duty personnel of units. Unit equipment, as, for example, water vehicles, requiring skilled use, are kept at all times under the skilled supervision of the hygiene staff-sergeant attached to the unit;

(10) It gives to the R.M.O. of each unit an experienced and permanent N.C.O. (A.A.M.C.) of adequate rank under his own control, and on whom he can rely to assist him in the selection and training of the hygiene and water duty men of his unit, and of any special squads required for special duty (e.g. malaria squads). The R.M.O., thus reinforced, should have much keener interest in and enthusiasms for these aspects of his duties. It thus strengthens initiative and the effectiveness of hygiene within the unit.

(11) It is economical in manpower, dispensing with the unnecessary privates, tradesmen, cooks and clerical staff of a field hygiene section;

(12) It enables D.A.D.H. and hygiene officers and N.C.Os. to give their whole time to hygiene duties, whereas under the field hygiene section system much time was employed in the administration and movement of the unit in the field;

(13) It is elastic and adaptable to the need of a division in the field on a line of communications area or any other military administration. It can expand or contract according to actual requirements. In field operations where, for instance, a division may be widely dispersed, and even units such as battalions split up for operational purposes, the system remains effective for each unit carried within itself its own hygiene set-up.

The D.G.M.S. recommended the adoption of the new organisation, an official instruction was promulgated on 3rd July 1942 and late in 1942 field hygiene sections were disbanded.

Naturally certain developments and modifications were found desirable. One of the most significant was the expansion of the Corps Hygiene Training Cadre approved on the War Establishment of New Guinea Force into a hygiene school fully equipped with teaching material and lecture facilities, and the ordinary requirements of a military unit. Further trial of the new organisation proved that it was flexible, and experienced officers were able to exploit this feature, which enabled the plan to be fitted into widely varying terrain and circumstance.

In June 1943 the outlook towards hygiene in New Guinea was found by Major K. Brennan, D.A.D.H. of New Guinea Force, to be most encouraging and sympathetic. The reorganisation worked well, and was favourably viewed by the D.M.S. of First Army. An Administrative Instruction was drawn up by Major English which consolidated all the orders concerning health and hygiene. This simplified both the supervision and teaching of hygiene. English further commented on the improvement wrought by the new method. He found that this improvement had been evident during the eighteen months elapsing after the introduction of the altered establishment: this was due to a number of factors. These were a general increase in knowledge and experience of hygiene officers, the influence of schools and training, on combatant as well as technical personnel, a general awakening of hygiene consciousness; a stricter enforcement of methods and the spreading of knowledge of epidemiology. He considered that the appointment of malariologists and entomologists had done much to place the general cause on a more scientific basis. At corps level the need was felt for more skilled assistance to the corps A.D. of H., so that he could send a competent technician round to demonstrate and implement methods. The establishment was insufficient for the work to be done in some parts of Australia, where the units concerned were responsible for the hygiene of a wide area. The existence of an Allied Services Hygiene Board in Western Australia was found to be of particular value.

The reorganisation was not so easily applied in small units, but even in the absence of definite instructions most of the units allotted an N.C.O., not belonging to the A.A.M.C., for the work of hygiene control, and this worked well. The Corps Hygiene Training Cadre became the New Guinea Force Hygiene School, with adequate facilities, and was already busy giving courses for officers, including R.M.Os. and frequent courses of instruction for water duty personnel.

Water supplies for troops were not satisfactory in all places, and Holmes maintained that the number of water tanks available was insufficient, and would not be able to supply demands in Australian military areas should action take place. Sterilisation of water supply was faithfully performed by units as a rule, and education of the water personnel produced a more palatable drinking water with a correspondingly favourable result on the troops' reaction to the methods of hygiene. Very few units in the Moresby area used the filtration apparatus on water carts, but filtration was carried out there at the pumping station. Water sterilising outfits had given a great deal of trouble, many of these having lost efficiency through effluxion of time and the action of climatic conditions. Replacement to ensure fresh material was desirable. Water duty men, not members of the A.A.M.C., worked under the unit medical officer, and carried out chlorination and detasting and helped in filtration.

Water sterilisation may here be briefly summarised. In the South-West Pacific Area filtration was given up, because it was not essential. Units sending for water found that if they filtered as well as chlorinated they

received less than their requirements. The pump and filter units often gave trouble, mainly because the driver had not been adequately instructed. The mobile army truck could filter 500 gallons in half an hour with a pressure pump. Australian-made filter earth was found satisfactory on test, working as well as the imported *Kieselguhr*. In some instances fouling of wells had been unavoidable by reason of the high water table, and a conservancy system of sanitation was necessary in order to maintain a pure water supply. Individual chlorination had to be trusted to some extent, but it was not satisfactory. The tablets varied in friability and hardness and in solubility, and in any event there was reason to doubt if soldiers would be any more punctilious about this duty than other obligations of hygiene. Where possible, bulk chlorination or chloramination was satisfactory if a correct technique was used. On few occasions only were the results unsatisfactory: this was due to insufficient chlorination. It was desirable that water duty men and other unit hygiene details should attend refresher instructional courses at corps or division in the field, or at the Land Headquarters school.

Later experiences in hygiene were of interest. Some of these have already been incorporated in medical notes on campaigns, such as the Huon and Ramu operations. Brief references may be made to others. A mobile hygiene training cadre was established in II Australian Corps, and after planning and preparing material in the Land Headquarters Hygiene School in Sydney, moved to the Atherton Tableland in April 1943. Here the cadre moved from unit to unit and held courses for officers and N.C.Os. In October 1943 the cadre moved to New Guinea with corps headquarters, and by October had trained 589 personnel of all ranks in hygiene and water duties. The instructional staff also had the opportunity to work under attachment to the 7th and 9th Divisions under operational conditions. This enabled necessary variations to be made in methods and materials, and placed emphasis on improvisation in the field.

Schools were held during 1944 also, when II Corps had become I Corps. From the middle of July 1944 to the end of March 1945, 1,873 personnel of all ranks had received instruction in hygiene, water purification and mosquito control. In April 1945 the cadre moved to Morotai and men were attached to the 7th and 9th Divisions for the periods required during the operations on Borneo. Some need was felt for the provision of self-contained mobile workshops, but the cadre proved elastic and satisfactory as a practical means of disseminating knowledge and methods of securing adequate hygiene in the field.

Lieut-Colonel C. E. A. Cook prepared a special report on the Oboe (Borneo) operations, and made it clear that the ideal of thorough indoctrination of the individual soldier was the pivot of hygiene training. To attain this it was necessary to maintain effective company and platoon training. The method adopted was the use of standard lectures, suitable for the individual soldier, the training of unit instructors, special lectures to senior officers, the holding of courses designed for specialist personnel, and insistence on uniformity and high quality of standards. This standard

was on the whole high, but often weakest among reinforcements. Soldiers not subjected to this training were lamentably deficient in some instances. In one case, during the final operations, neglect of basic precautions produced a badly fouled area, originally virgin jungle, from which an outbreak of Schmitz dysentery arose. On the whole communicable disease was well controlled. Skin diseases were very common; a survey of 1,200 men in May 1945 showed that 27.3 per cent of all ranks were suffering from some form of skin disease, and these affections accounted for 25 per cent of first attendances at R.A.Ps., and up to 20 per cent of all evacuations to medical units for conditions other than injury.

A special factor was introduced into local conditions by the presence of prisoners of war and repatriates. Medical inspection of all these were promptly made, and repeated immediately before any movement took place. Clinical and laboratory investigations to reveal important communicable diseases were carried out at Morotai and if necessary treatment was begun. The problems set in hygiene during this important last stage in the Australian war against Japan were successfully met, and an encouraging view could be taken of the working of the reorganised hygiene services. It was a bold step to make radical alterations in the principles and practice of the hygiene service during active operations, but the results amply repaid all the thought and effort involved.

AUSTRALIAN GENERAL HOSPITALS

As the scope of the war enlarged, the need for more accommodation in service hospitals also increased throughout Australia. These served the military forces of Australia, and also received and cared for casualties from the more forward areas. The high quality of the technical staffs and the amount of accommodation available for the purpose gave them special value, particularly as they were semi-permanent in nature, and could be moved if necessity arose.

CHAPTER 13

BOUGAINVILLE

AFTER the return of part of the A.I.F. to Australia, the military position called for reorganisation of the Defence Forces. These needs called into being First and Second Australian Armies. Only the former became fully functional, while the Second Army remained in Australia and carried out various necessary though often unexciting tasks. For some time First Army, comprising I and II Australian Corps, had its headquarters at Toowoomba in Queensland, and Second Army Headquarters was at Baulkham Hills on the outskirts of Sydney. III Australian Corps, with an armoured division was in Western Australia, under direct headquarters control. Land Headquarters was established in Melbourne, and General Blamey opened an Advanced Land Headquarters in Brisbane, where General MacArthur's headquarters was also situated until August 1944, when it was moved to Hollandia.

The convincing victories of 1943-44 permitted the American Pacific forces to move on from New Guinea to other island bases, from which further combined operations led to the ultimate conquest of the Japanese.

At the beginning of April 1944, Headquarters I Corps commanded the 3rd and 6th Divisions in the Atherton Tableland, and was directed to take over from the II Corps which had the 5th Division and the 29th Infantry Brigade under command, and was in a tented headquarters near Finschhafen. The II Australian Corps then took over the headquarters left in Australia by I Australian Corps. On 11th April both these headquarters moved, and then, on 12th April the two corps headquarters changed designations, I becoming II Corps, and II becoming I Corps. Incidentally this change caused not a little discontent among staff officers, particularly those of I Corps which had operated overseas and valued its record and therefore its tradition. On 20th April, Headquarters II Australian Corps assumed the functions of Headquarters New Guinea Force, which had acted as the operational command in New Guinea, established in Port Moresby at the time of the first threats of Japan to New Guinea. On 6th May the strengthened Headquarters II Australian Corps gave up its designation and assumed the title of Headquarters New Guinea Force. This headquarters was situated at Lae, and had under command 5th and 11th Australian Divisions, 29th Infantry Brigade and the Base Sub-areas at Moresby, Milne Bay, Buna, Lae and Finschhafen. This arrangement was maintained until 2nd October 1944, when further reorganisation and consolidation of the Australian forces were necessary. The reason for this was chiefly related to manpower, since the wartime expansion of industry and the need for increased food production demanded a reconsideration of the future policy of recruiting in Australia. The II Australian Corps was then rebuilt from Headquarters New Guinea Force, which ceased to exist, its functions being assumed by First Australian Army.

Early in 1944 MacArthur was planning an advance on the Philippines, and for this purpose required more troops. Six American divisions and part of a seventh were absorbed in defensive roles. First Australian Army, commanded by Lieut-General V. A. H. Sturdee, took over these tasks and thus set free the American forces needed for the advance to the north. Planning in General Headquarters late in 1944 proposed the employment of the 6th and 9th Divisions in combined operations against Borneo, with the 7th Division held in reserve so that it might be fully rehabilitated after its hard campaign in the Ramu Valley. However, the 6th Division was assigned a demanding role in the difficult and highly malarious country at Aitape, and the 7th and 9th Divisions were used against Borneo.

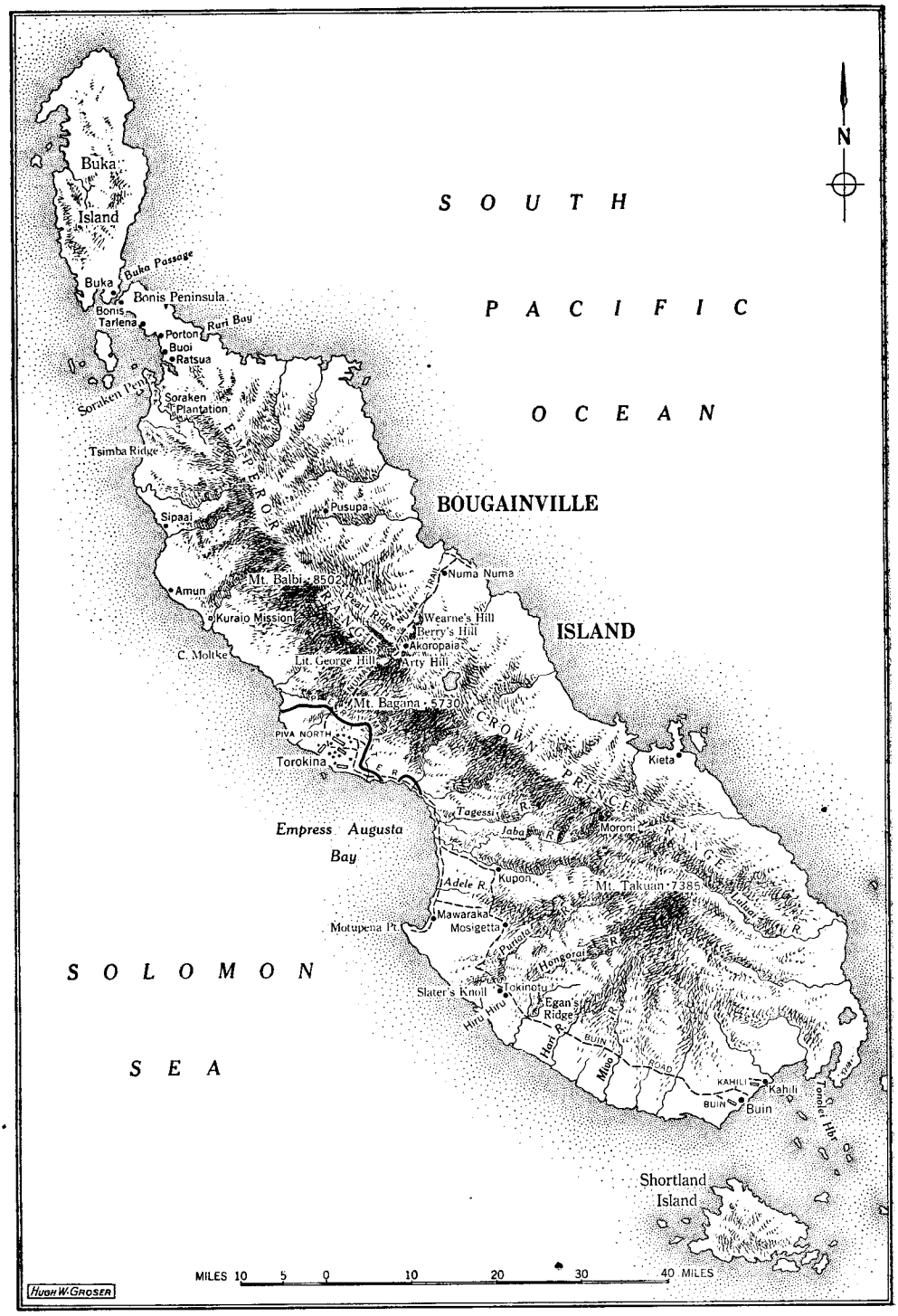
This left the commander of First Australian Army with several campaigns for which the forces used were as follows: II Australian Corps (Lieut-General S. G. Savige) in the Solomons, with 3rd Division (Major-General W. Bridgeford) in the southern sector of Bougainville and two brigades, one in the outer circle of islands and one in the northern sector: 5th Division in New Britain (Major-General A. H. Ramsay) the headquarters being later relieved by headquarters 11th Division (Major-General H. C. H. Robertson) and 6th Division (Major-General J. E. S. Stevens) in the Aitape area, later extended down the coast to Wewak.

The Australian forces were thus heavily committed during the year 1944-45, and far from merely maintaining a defence perimeter, they fought active campaigns, increased their holdings of territories and reduced the Japanese troops in these areas to relative impotence. These campaigns all differed from one another; each presented its individual problems, and added to knowledge, particularly in relation to preventive medicine.

The difficulties imposed by the formidable terrain, by the enemy, and even those due to human perversity showed varied features in these final struggles. In contrast stood the convincing victories in Borneo, where even stiff opposition was overcome by all the measures that could be devised by a plan on the grand scale and troops which showed how they could make the best use of opportunity.

BOUGAINVILLE

The general characters of the islands of the Solomons group were much the same as the country over which the Australian troops had been fighting since their actions on the Owen Stanley Range. Bougainville, the largest of these islands, was 110 miles in length and its breadth some thirty-five miles or less. A chain of rough steep mountains ran along the long axis of the island, the Emperor Range in the north, and the Crown Prince Range in the south. The average height of these mountains was over 6,000 feet, but Mount Balbi, an active volcano, rose to 8,500 feet at the southern end. Mount Bagana, another active volcano, joined the two mountain masses. Towards the south-west of the island there were rich plains some twenty miles wide, but deep gorges and precipitous ridges abounded on the descents from the central features. In some places movement was practicable only by foot over steep tracks running over


N
SOUTH
PACIFIC
OCEAN
SOLOMON
SEA
BOUGAINVILLE
ISLAND
Buka Island
Buka Passage
Buka
Bonis Peninsula
Bonis
Tarlena
Porton
Buoi
Ratsua
Runi Bay
Soraken Pen.
Soraken Plantation
Tsimba Ridge
Sipaai
Pusupa
Numa Numa
Amun
Mt. Balbi 8502 Ft.
Kuraio Mission
Wearne's Hill
Berry's Hill
Akoropaia
Arty Hill
Lt. George Hill
C. Moltke
Mt. Bagana 5730
PIVA NORTH
Torokina
Empress Augusta Bay
Tagessi R.
Jaba R.
Moroni
Kieta
Kupon
Adele R.
Mt. Takuan 7385
Mawaraka
Mosigetta
Motupena Pt.
Hongorai R.
Slater's Knoll
Tokinotu
Egan's Ridge
Hiru Hiru R.
Hari R.
Buin
Moa R.
ROAD
KAHILI
Kahili
BUIN
Buin
Shortland Island
MILES 10 5 0 10 20 30 40 MILES
HUGH W. GROSER

sharp ridges. The hills and slopes were covered by forest, watered by copious daily rainfall, which often so swelled the many rivers that they became impassable. Tracks were few and it was necessary to construct a three-ton road and corduroy jeep roads for the transport of supplies for an advancing force.

Towards the centre of the island a track known as the Numa Numa trail led down the bed of the Laruma River and thence across the island to the eastern side. A series of gorges converged to the main cleft through which the Laruma River led to the sea, and from a high feature Choko Ridge ran off parallel to another known as Pearl Ridge. This ridge was of some importance as it overlooked the seaward slopes to Torokina, and at the time of the arrival of the Australians was held by the Japanese.

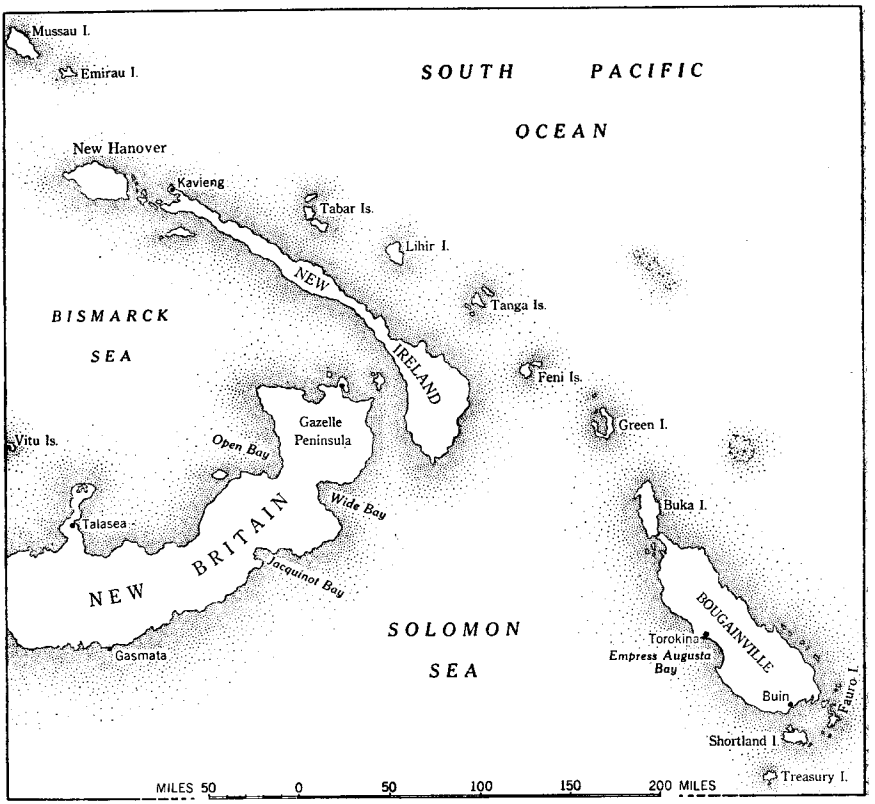
The Americans had built a motor road to a roadhead in the Laruma gorge, from which supplies were carried by porters up the steep escarpment into the central mountains until the trail could be picked up again and followed to Numa Numa on the coast.

The topographical features of the island divided it into three sectors. The central sector was that running from Torokina to the opposite coast astride the Numa Numa trail. The northern sector comprised the northern peninsula on which was the Bonis airfield, separated from Buka Island by the narrow Buka passage. Other small peninsulas projected from the flat coastline, towards which the Emperor Range flattened out, intersected by many rivers. The southern sector also contained a number of large rivers: some could be crossed by ford except after heavy rain, others were never less than waist high at crossings. The rich alluvial soil round Buin produced many native gardens, a lavish source of food, and therefore held tenaciously by the Japanese. This sector constituted the chief defence responsibility of the 3rd Division, and here were the main concentrations of the Japanese force.

THE OUTER ISLANDS

The outer islands were Emirau Island, Green Island, Treasury Island and Munda. In March 1944 these islands, which had largely fallen into Japanese hands, came under Allied control, and were used by the American forces in the development of airfields and ports, as adjuvants to the larger air and sea bases. When the Australian Military Forces relieved the American forces in the Solomons, an Australian infantry brigade, the 23rd, was assigned the task of holding the outer chain so as to keep these islands safe for the American and New Zealand naval and air installations. By October 1944 the 23rd Brigade was sited as follows: Emirau Island, to the north of New Ireland, 8th Battalion Group; Green Island, 23rd Infantry Brigade (less two battalion groups); Treasury Island, 7th Battalion Group (less one company); Munda, an air base on the New Georgia Group, one company of 7th Battalion. The 23rd Brigade was thus split into four island garrisons, and further sub-division was necessary for the 17th Field Ambulance, which under command of Lieut-Colonel W. M. Irwin, undertook the medical care of the scattered brigade. There

were certain difficulties in the arrangement of transport to the islands, and in provision of ordinary facilities. Water was obtained by condensation and catchment on tent roofs, and became scarce in dry weather. Sanitation required the blasting of latrines from the solid coral of the islands' foundation. Even the approach of ships was not easy: Liberty ships could not anchor in the lagoon, nor in the deeper water outside, and had to cruise while unloading.



The headquarters of the ambulance was stationed with brigade headquarters, and the 27th Battalion of the 23rd Brigade Group, on Green Island. A surgeon from the 2/1st A.G.H. was attached to the M.D.S. on Green Island for the early part of 1945 but was later recalled. "B" Company was on Emirau Island with the 8th Battalion, and "A" Company with the 7th Battalion on Stirling Island of the Treasury Island Group. A light section of "A" Company went to Munda, in the New Georgia Group with part of the 7th Battalion.

In November, the need for treatment of natives arose on Mono Island of the Treasury Group. Angau medical staff were finding it difficult to

cope with their expanding commission, but Major J. H. Edwards of the 17th Field Ambulance undertook their treatment, while stores and laundry facilities were given unofficially by the American Navy.

Anti-malarial work was needed on the islands, and the field ambulance, with its sub-divisions took over this responsibility: they also carried out inoculations for cholera. Sufficient bed accommodation was held for general needs: in January 1945 the headquarters held sixty beds, "A" Company fifty beds, and "B" Company forty. Evacuation of sick was either by sea or by air. In February a flying-boat service was arranged from the Treasury Island Group to Cairns. The most frequent source of invalidity was skin disease. Very few cases of malaria were seen on any of the islands, and the total sickness rate was 82 per 1,000. Shortage of fresh water was believed to be a cause of skin affections. At one time 90 per cent of the ambulance headquarters were so affected, the most common types of skin affections being *miliaria rubra* and bullous impetigo. Illustrating the communicable nature of neuroses and the adverse effect of isolation, it may be noted that neuroses were common, especially on Green Island.

Following heavy rain in March troubles related to water shortage lessened, but mosquito control was for a time unsatisfactory. On 21st April some regrouping of detachments took place, as the likelihood of offensive action on the islands dwindled. The headquarters moved to Bougainville and set up in Torokina.

On 31st December 1944 II Corps made a recommendation that the outer island garrison should be reduced to a company group on Emirau, Green and Treasury Islands, and on 19th March this was approved by First Australian Army. Movements were carried out in small ships and returning aircraft, and the balance of the brigade was concentrated at Torokina as a reserve.

The altered policy of the outer island defence brought about changed dispositions of the 23rd Brigade, and the alterations in medical arrangements were discussed with Major R. R. Winton, D.A.D.M.S. II Australian Corps, at the end of March. Only small holding units were then necessary, with twenty beds on Emirau, surgical work being done by an R.N.Z.A.F. hospital, fifteen beds on Green Island, and ten beds on Treasury where there was still an American naval hospital. All medical service was provided at Munda by American medical units.

Detachments from the 17th Field Ambulance provided staff for A.D.Ss. on Emirau, Green and Treasury Islands; the greater part of the unit was now on Bougainville working in the central and northern sectors with units of the 23rd Brigade.

A further thinning out of the island medical force took place on 14th June. The 8th Field Ambulance then took over the Numa Numa trail in the central sector, Bougainville, and the 17th Field Ambulance was thereupon assigned to the relief of the 19th Ambulance in the northern sector. By the end of the month Australian medical detachments had left the outer islands.



(Australian War Memorial)

Loading an ambulance launch from the 109th C.C.S., Motupena Point.



(Australian War Memorial)

Heavy surf at Toko beachhead, Bougainville, makes landing difficult.



(Australian War Memorial)

Jeep ambulance transporting battle casualties from the 57th/60th Battalion during the advance south of the Hongorai River.

MILITARY ARRANGEMENTS

In October 1944 the 3rd Australian Division, commanded by Major-General Bridgeford, arrived on Bougainville and the headquarters took over from the XIV United States Corps until the II Australian Corps arrived in November. The 7th, 15th and 29th Brigade Groups made up the division, together with the 2/8th Commando Squadron, a squadron of the 2/4th Armoured Regiment, and the 2nd and 4th Field Regiments. The 6th Brigade was sent under command of the 5th Division to the New Britain operational area.

The first phase of the activities of the 3rd Division was occupied with the move to Bougainville and the details of taking over from the American force. An immediate duty was that of defence of the beachhead at Torokina, where the headquarters was located. Between 13th and 20th November Headquarters II Australian Corps arrived at Torokina, and assumed command on 22nd November.

The main tasks confronting the Australian force were the defence of the Torokina perimeter and the gaining of information concerning the Japanese on the island. It was evident that operations would be carried out in the southern sector where Japanese troops were concentrated and food was plentiful. It was necessary to prevent the Japanese from approaching Torokina by the cross-island route, the Numa Numa trail, and to allow them no opportunity for reinforcing the central or southern sectors with troops from the north. The overall plan was to attack in the three sectors: in the north to force the Japanese into the narrow Bonis Peninsula where their forces could be destroyed; in the centre to clear them from the high ground and to threaten the main enemy line of communications to the east coast, and in the south to attack the main enemy concentration.

MEDICAL ARRANGEMENTS

By December some of the field units were actively engaged in all three sectors. The field ambulances allotted to the Solomons area were the 7th, 8th, 11th, 15th and 19th. The 17th Ambulance was attached to the 23rd Brigade and undertook the medical care of the outer ring of islands while this was necessary. Most of these units arrived towards the end of 1944, and in November the division had in addition under command, the 2/1st Base Depot Medical Stores, the 2/1st and the 19th Malaria Control Units, the 2/3rd Convalescent Depot, and the 115th Mobile Bath Unit. There were also three larger holding medical units; the 109th Casualty Clearing Station, which arrived at Torokina on 8th October and came under divisional control; the 106th C.C.S. in the 4th Base Sub-area, and the 2/1st Australian General Hospital. The 109th C.C.S., under command of Lieut-Colonel M. G. Edison, occupied the site relinquished by the 112th United States Medical Battalion, and was open for patients on 12th October, having 145 beds by the end of the month. The 2/1st A.G.H., under command of Colonel J. Leah, opened on 10th January 1945 on a site which had to be cleared of virgin jungle before the extensive installations of a general hospital could be made. The medical and surgical

divisions were in charge of Lieut-Colonel C. B. Sangster and Lieut-Colonel J. O. Smith respectively. On opening, the A.G.H. took over 100 patients from the 106th C.C.S., commanded by Lieut-Colonel Powell, and by the end of February 930 beds were ready, and 885 patients had been admitted during the month. At a later stage in March permission was given for the hospital to expand to 1,200 beds. Before the general hospital was fully available for patients, an arrangement was observed whereby the 109th C.C.S. received admissions from the southern sector, and the 106th C.C.S. from the northern sector.

At appropriate times the hospital could transfer patients from Torokina to the 2/7th A.G.H. at Lae, from which they could be transferred to the mainland if necessary. Hospital ship transport could also take patients direct to the mainland, and limited air service was available. Surgical teams were provided by detaching surgeons from the base units: throughout the campaign the 109th C.C.S. made available the services of two surgeons on its establishment. This arrangement was facilitated by the largely static role played by the clearing stations.

Colonel F. K. Wallace was A.D.M.S. of the 3rd Division, with Major R. E. Wherrett as D.A.D.M.S. and Major W. D. Exton as D.A.D.H. Under divisional command were the regimental medical officers of the 2/8th Commando Squadron, the 2/4th Armoured Regiment, the 2/11th Field Regiment, the R.A.E. 3rd Division, and the 9th, 15th, 24th, 25th, 42nd, 47th, 61st, 57th/60th and 58th/59th Infantry Battalions, and the Papuan Infantry Battalion.

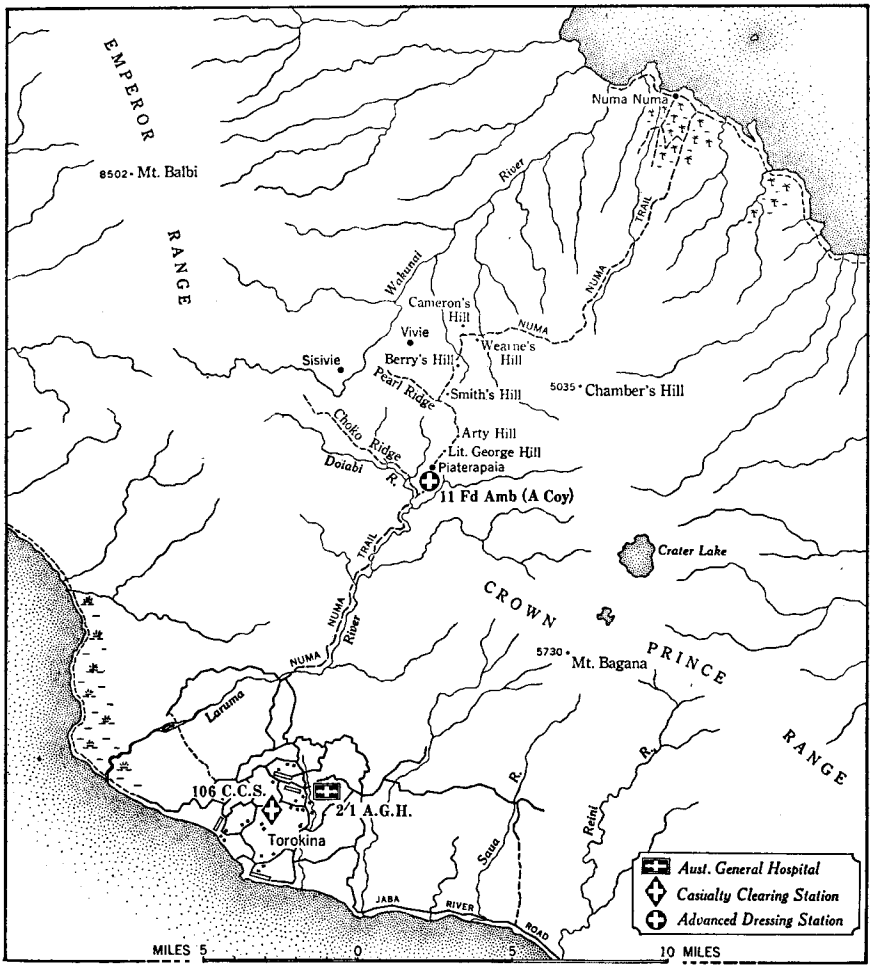
It may be noted that the field ambulances were equipped according to the tropical scale. This provided accommodation for troops but not for holding casualties, hence there was need for extemporisation to provide facilities for resuscitation and surgery, and in addition, wards in which patients could be held for ten days. Though these methods were used with great success, on Bougainville appropriate tentage could have been carried, as motor transport was practicable in the coastal areas.

CENTRAL SECTOR

Relief of the United States forces occupying the central sector in the Doiabi-Sisivie area began with the arrival of part of the Australian 7th Brigade to which was attached "A" Company of the 11th Field Ambulance. This company, servicing the 9th Battalion Group, on 26th November opened an A.D.S. at Piaterapaia (Erie), a roadhead which covered both flanks, and permitted transport of patients by road to the C.C.S. direct. A surgical team from the 109th C.C.S. was working at the A.D.S. under command of Major J. C. Balzer. An R.A.P. was set up near Piaterapaia serving two companies in contact with the enemy: from here and from Sisivie casualties were evacuated to the A.D.S. by native carrier teams. The times taken were eight hours on one flank and two hours on the other. A medical staging post on the track cared for casualties sent along this route. From the A.D.S. to the C.C.S. the journey of fifteen miles took up to two hours, depending on the state of the Laruma and Doiabi Rivers.

Though the motor ambulances had a high clearance and had little trouble at the crossings, the rivers had to be crossed twenty-six times on each trip.

The first action of the Australian troops took place on 29th November when the 9th Battalion attacked and captured Little George Hill, one of several high topographical features which were military objectives. After the capture of Little George, the 9th Battalion Group attempted to outflank the enemy positions on Pearl Ridge and to sever his communications,



but the enemy opposition was too strong. On 18th December an assault was made on Artillery Hill, a 300-yard long ridge, and after preliminary bombardment a company attack succeeded in taking it in spite of the great difficulty in climbing the masses of earth thrown up by fire from the 25-pounders. The 9th Battalion was relieved by the 25th on 21st

December, so that this unit might add to its experience in jungle fighting: the medical arrangements remained the same. Very little action took place during the period of relief.

The due ceremonies of Christmas were observed, and special meals were prepared and appreciated. An attack was planned on Pearl Ridge for the 30th, and information was collected by patrols towards this end. This ridge rose to a height of 2,800 feet, overlooking the west coast and the anchorage of Torokina. The attack began with air strikes, and continued on the following day. By 1st January Pearl Ridge had been taken against strong opposition. During the attack on Pearl Ridge supplies of serum were available for resuscitation in the R.A.Ps. and A.D.S.; whole blood was supplied by the Red Cross Transfusion Service through the 11th Field Ambulance M.D.S. and volunteer donors were to hand. Forty-three men were treated for battle casualties and forty-seven for illness.

The 25th Battalion was relieved by the 26th Battalion of the 11th Brigade on 4th January, to allow the 7th Brigade to be concentrated for future operations in the southern sector. "A" Company of the 11th Field Ambulance handed over to "A" Company of the 19th Field Ambulance, which arrived with the 11th Brigade in December and provided service at the A.D.S. on the Numa Numa trail. Majors A. L. Newson and T. F. Rose were attached as a surgical team from the 106th C.C.S.: facilities for surgery and holding were good. This relieved the command of the 3rd Division from further responsibility in the central sector. The task of the 11th Brigade was now to prevent the enemy from penetrating the Laruma River area, and to establish patrol bases towards Numa Numa, but without advancing beyond Pearl Ridge.

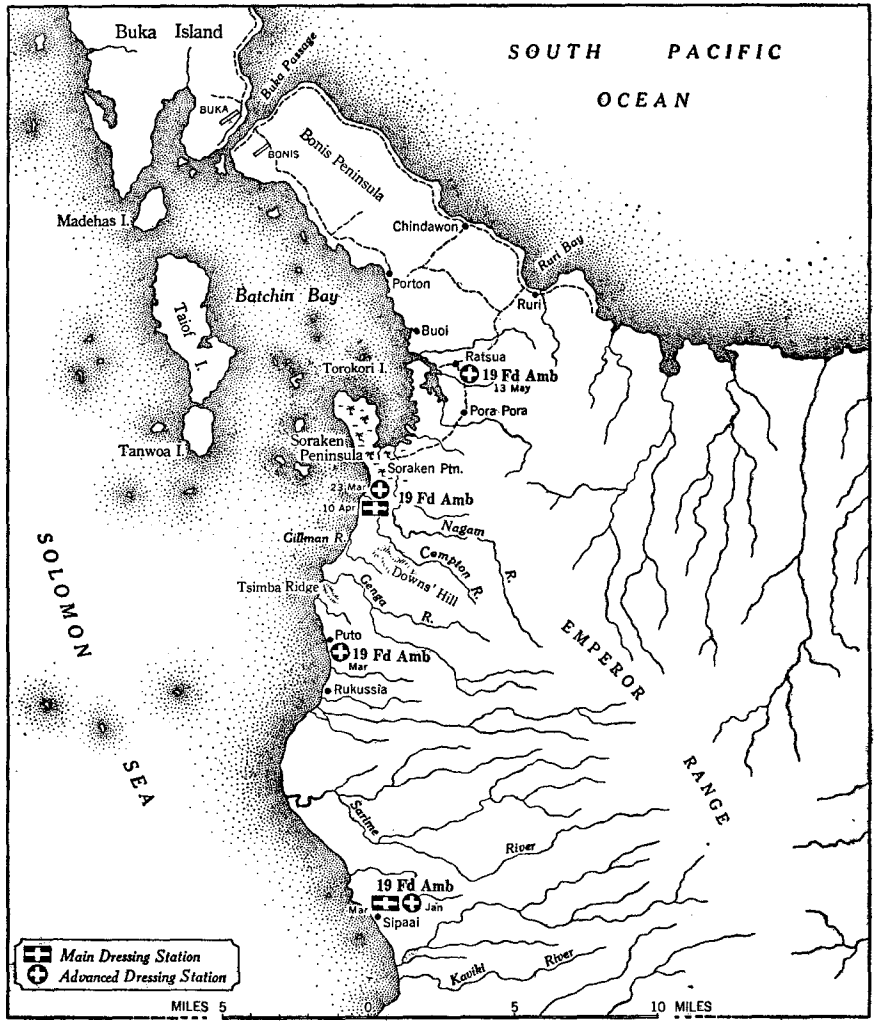
Planning in the central sector provided for continuous and aggressive patrols penetrating several miles into enemy areas without any major engagement. The medical responsibility for the line of evacuation from the Numa Numa trail was taken over by the 8th Field Ambulance on 23rd March with the headquarters and "B" Company situated at the road-head. In order to strengthen the 11th Brigade in the northern sector, the battalion of this brigade which had been engaged on the Numa Numa trail was relieved on 18th April, by a battalion of the 23rd Brigade, which had been withdrawn from duty on the outer ring of islands. This position in the Pearl Ridge area remained unchanged until II Australian Corps reviewed the whole situation, and instructed the forward units to undertake such operations as would destroy Japanese strongholds without using more than a platoon in an attacking force. Following this decision, the forward troops were successful in establishing positions on Smith's Hill, Berry's Hill, Wearne's Hill, and Tiernan's Spur: these actions were conducted by fighting patrols with the support of artillery and mortar fire. Company bases were established as far forward as Cameron's Hill. When the position permitted, the 8th Field Ambulance brought up an A.D.S. to Smith's Hill. Evacuation from these points was made by bearer teams and jeep ambulances: there were very few casualties and this evacuation line was not much needed during the remainder of the campaign.

NORTHERN SECTOR

In Northern Bougainville the Japanese had forces derived from army and navy units: on the east and west coasts of the northern sector the army units were in small garrisons. The Australian plan was, in general, to force the Japanese into the Bonis Peninsula and then contain them so as to prevent attempts to reinforce their troops in the south. As a preliminary it was further planned to reduce these enemy forces substantially by aggressive patrolling, and to eliminate the series of small garrisons from Cape Moltke to Soraken. Towards this end the 31st/51st Battalion of the 11th Brigade went northward from Torokina along the coastal track to set up a patrolling base; but no contact was made as far as Kaviki River. One company went up on patrol and reported the Sipaai area clear: the remainder of the battalion landed there and established a forward base, and an A.D.S. was set up by "B" Company of the 19th Field Ambulance. The battalion advance continued to Rukussia without hindrance, but Japanese troops were reported in the region of Tsimba Ridge near the mouth of the Genga River. Evacuation was by barge from the A.D.S. to Torokina. From 21st to 28th January the Australians made persistent attacks on the strong Japanese position on Tsimba Ridge, but it was not until 6th February that a company assault with artillery succeeded in clearing the area after heavy fighting. This action produced over twenty wounded in the 31st/51st Battalion; the arrival of the ambulance craft *Stradbroke* from Lae permitted evacuation by sea to Torokina. The surgical team from the 106th C.C.S. under Newson, was transferred from the Numa Numa trail to the A.D.S. Sipaai on 8th February to help cope with the situation. On the 12th the battalion had to deal with strongly entrenched Japanese positions on Downs' Hill, in the rising ground inland from the Genga River. By the 19th the Japanese had been cleared from Tsimba Ridge and two days later the forward troops reached the mouth of the Gillman River. The 26th Battalion relieved the 31st/51st Battalion after the clearing of Downs' Hill on 4th March and began to patrol along the coast.

Early in March the A.D.S. at Sipaai moved with its attached surgical team to Puto. An inland patrol from the 26th Battalion on the 12th, encountered a strong body of Japanese at the Nagam River. On the previous night a company had landed north of the Compton River and a similar operation was carried out nine days later, a mile farther forward. Little opposition was met from the Japanese who were hurriedly withdrawing from the Soraken Peninsula towards Pora Pora. By 28th March they had ceased resistance in the north of the peninsula as an organised force. Thus the Japanese had to abandon an area in which there was considerable garden cultivation. During March the main body of the 19th Field Ambulance had consolidated at Puto, following the relief of "A" Company on the Numa Numa trail. "B" Company was now free to service the Soraken area with an A.D.S. The advance beyond Nagam River towards Pora Pora proceeded with little hindrance, except that due to the rough and difficult country. After the capture of Pora Pora the Japanese

line of communication from base of the Bonis Peninsula to the east coast was cut. These moves, together with an unopposed landing on Torokori Island by troops of the 26th Battalion, secured Ratsua from inroad from the sea.



Meanwhile the 19th Field Ambulance established an M.D.S. at Soraken by the end of April. This had well-constructed wards and theatre, with a surgeon attached at all times. With the capture of Ratsua the A.D.S. was established by "A" Company in that area. Evacuation from forward areas was carried out mainly by barge; *Stradbroke* continued useful work back to the base. This remained the chief medical centre for the sector. On 11th

May the advance was continued across the Bonis Peninsula eastward to Ruri Bay. Light sections of the ambulance were again used to afford necessary medical support to the fighting troops. The 11th Brigade had now completed its task of pressing back the enemy to the Bonis Peninsula and had overrun their garrisons.

The brigade was ordered to consolidate its positions without being committed to major actions. As it was necessary to ensure full supplies to the southern sector, the 11th Brigade was instructed to reduce the force in contact in the forward area to one battalion. The importance of the narrow Chindawon-Porton area was realised; it would be possible to control it by one battalion. A landing was made on 8th June by troops of the 31st/51st Battalion at Porton in an endeavour to outflank the known strong enemy position in Buoi plantation. Troops also moved up along the coast. The Japanese were known to be occupying Porton, but their strength was unknown. Early on 8th June a company group landed unopposed, but the craft of the second wave grounded on the reefs near the shore. The Japanese brought up reinforcements at dawn and launched strong attacks. That night heavy enemy fire prevented the landing of stores and ammunition and the landing force was compelled to retire; this movement was not completed till the night 10th-11th June, thus the objects of the landing were not realised.

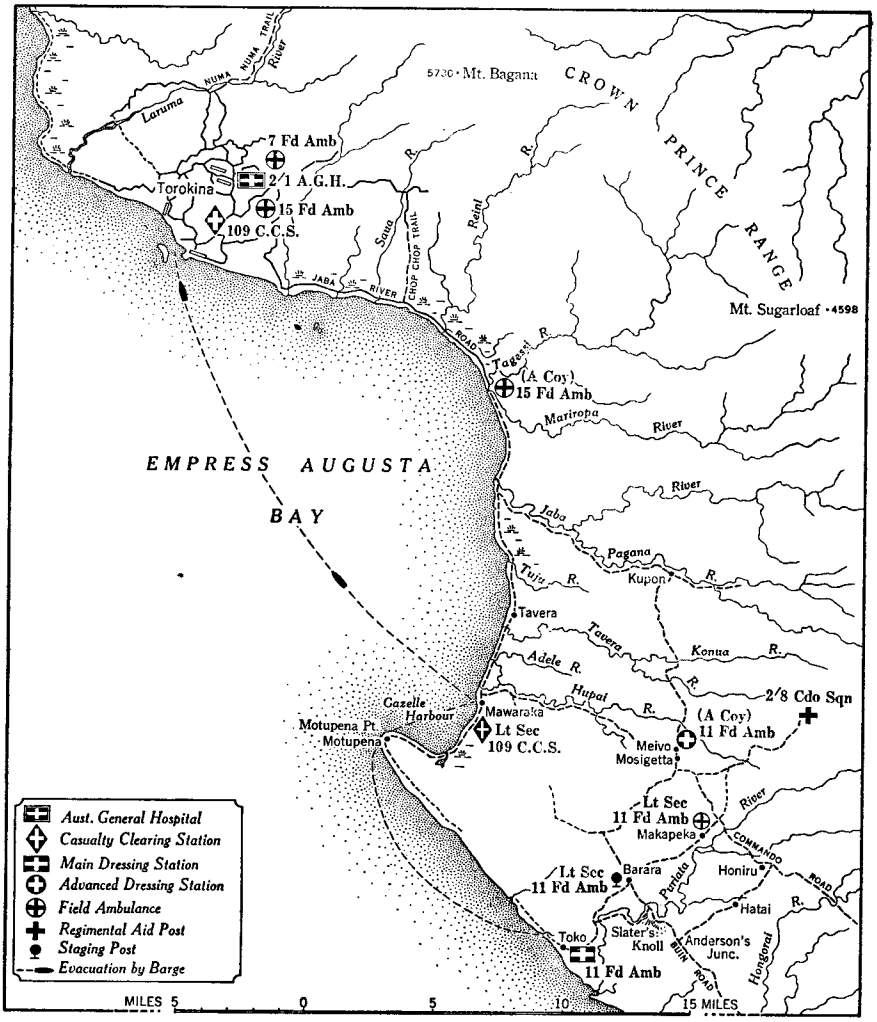
The Australians had many casualties, including some members of the field ambulance, nevertheless they inflicted heavy losses on the enemy. The M.D.S. at Soraken was able to deal efficiently with the wounded, and the hospital launch *Stradbroke* took back fifty casualties to Torokina. Rose replaced Newson as surgeon in charge of the surgical team. Thereafter active patrolling continued against a strongly resisting enemy: on 12th-13th June the Australian forces were consolidated, and supply lines shortened and adequately protected.

The 17th Field Ambulance relieved the 19th Field Ambulance on the 22nd, maintaining the same service to the forward troops. The 23rd Brigade took over the command of the sector from the 11th Brigade. After the Porton action the Japanese became more aggressive and penetration by their forces could not be prevented. Accordingly, the line held between Ruri Bay and Ratsua was shortened, and two battalions were concentrated in the Ratsua-Bonis area. These changes were completed by 24th July and aggressive patrols were resumed at once. This restored the balance again, and by the end of July the enemy was only able to carry out minimum movements south of their chief defensive line. When this end was achieved the position was maintained unchanged until hostilities ceased on 15th August.

THE SOUTHERN SECTOR

The first organised group to arrive at Torokina to begin the relief of the American Forces on Bougainville was the 4th Base Sub-area, whose units were given priority of shipping so that arrangements could be put in train for the maintenance of base and field troops. The advanced

headquarters of the base opened on 11th September at Torokina, and units arrived by ship on the 20th. After a couple of weeks the organisation was ready to receive troops and maintain them. The immediate task before the elements of the force, was the taking over of the defence of the



Torokina perimeter area from the American forces. The 3rd Division was allotted this duty, and also had to gather all possible information about the Japanese in the southern sector. In addition it was important to prevent the enemy in the central sector from approaching Torokina by the Numa Numa trail which ran through the cross-island route to the opposite coast.

By the middle of December sufficient information was to hand for the preparation of plans for offensives on the central, northern and southern fronts. On the important southern sector, where enemy concentrations were gathered, these plans provided for reconnaissance by the use of patrols of the 2/8th Commando Squadron, and for an advance towards the southern end of the island. The first objective was Mawaraka on the coast, and after that Mosigetta, a valuable garden area then under control of the Japanese. With these ends in view, II Corps approved the taking over of the defence of the Jaba River area as a contributory step towards the conquest of the enemy in the southern part of the island. It was realised that this campaign would be fought out in the southern sector of Bougainville. For this operational role the 7th Field Ambulance, commanded by Lieut-Colonel Meares, was attached to the 29th Brigade.

Advance parties of this brigade on 3rd December moved down the coast to the Jaba River as a preliminary to the capture of Mawaraka and Mosigetta. After a period of patrolling by the brigade, on the 18th, the 15th Battalion crossed the Jaba River and penetrated to the Tavera River and there established a patrol base. Meanwhile the 2/8th Commando Squadron had also carried out patrolling.

The field ambulance established an A.D.S. at Tagessi on 7th December and sent casualties twenty-three miles by jeep direct to the 109th C.C.S. A car post was opened on the north side of the Jaba River when a ferry service began at the mouth of the river on the 20th. First evacuation by hospital launch was made three days later to Torokina. Walking patients were sent to the M.D.S. which had been established on the Chop Chop trail near the coast. Arrangements were made on 24th December for the *Alea* to be ready to move up the Jaba River at night to collect casualties should this be necessary. Preparations were made at the car post for a team to be available for the carrying out of resuscitation.

The 15th Battalion crossed the Tavera River on 28th December and moved its patrol base towards Adele River. The 29th Brigade was now ordered to capture Mawaraka and to clear the Japanese from Motupena Point, and at the same time to expel them from the inland track, with the objective of taking Mosigetta. At the beginning of January the 7th Field Ambulance expanded the A.D.S. at Tagessi so that it became the main dressing station.

The general health of the force was good. In the middle of December the evacuation rate to hospital was the lowest on record, 9.5 per 1,000 per week. The malarial rate for the 29th Brigade at the beginning of January was also very low, 0.3 per 1,000 per week. A higher rate had been observed during the latter part of December; this was due to a break-down in atebrin administration on the troopship. The actual rate was somewhat in doubt, as a number of patients were classed as P.U.O. when no definite diagnosis could be made. The A.D.M.S. arranged for further pathological facilities as a check on diagnosis. Early in January a further rise took place in the rate, to 0.8 per 1,000. This was believed to be due to operational conditions with consequent relaxation of malarial

discipline. Accordingly, Wallace placed the 29th Brigade on a suppressive dose of atebrin of two tablets per day for a period of one month. Experience and research had shown that one tablet of atebrin a day was enough to suppress malaria, but the larger dose gave better opportunity for the blood atebrin concentration to be maintained at effective level. The malariologist to the corps, Major I. C. MacDonald, pointed out that the men might be encouraged to think that the official dose was not sufficient, but the justification of the larger dose lay in the fall of the incidence rate in the following month, with a consequent reduction of man wastage in forward areas.

The 47th Battalion moved south by barge to the Adele River on 11th January. At the barge-point was a transfusion and resuscitation team under Captain R. U. Bourke; from this casualties were evacuated. On the next day a party moved to the north bank of the Tuju River, and Captain H. Glynn-Connolly and a team, during a night crossing, set up a forward R.A.P. just off the beach south of the Adele River. Arrangements were begun to construct an A.D.S. south of the Tavera equipped to supply resuscitation and surgical service. The enemy were active in the area, and that day shelled the locality but without any direct hits.

The fighting in the Hupai area produced numbers of casualties from the 47th Battalion. These were treated in the dressing station as required, and were transferred by landing craft to the M.D.S., where the staff worked through the night. Many of the patients were severely wounded and suffered from multiple injuries. A lugger took eighteen patients to Torokina, and early on the morning of 13th January a workboat took three more. The A.D.M.S. visited the area and instructed that, as the 109th C.C.S. was full, any additional patients being sent to the base would be admitted to the 106th C.C.S.

The intensity of these engagements had already produced strain on the 109th C.C.S., and lest there be want of further emergency accommodation, the M.D.S. of the 7th Ambulance was equipped to hold up to eighty patients for the 29th Brigade. At that time access for surgical cases was good, and other special surgical arrangements were unnecessary, but there was need for additional transport. To meet this requirement two motor ambulance vehicles were allotted to the 7th Field Ambulance.

Patrols of the 42nd Battalion penetrated along the winding Hupai River near the coast, and into Mawaraka, but even in the settlement itself made no contact with any Japanese. Valuable documents were captured here, some within a day of their issue: after being dealt with by the local Intelligence staff they were passed to the higher formation. The whole of the Mawaraka area was completely cleared of Japanese, and towards Motupena Point further similar successes were gained by the Papuan Infantry Battalion, which dispersed the remaining enemy who fled, leaving equipment and more documents behind them.

The 29th Brigade, having now reached the Mawaraka area, was relieved on 23rd January by the 7th Brigade under command of Brigadier J. Field. On the previous day the 11th Field Ambulance had taken over the installa-

tions of the 7th; the M.D.S. was then at Tagessi, previously the site of the A.D.S., which was moved to Adele River. The former M.D.S. was reduced to a medical staging post.

There was now ample provision for the care of battle casualties, especially since the 2/1st A.G.H., accompanied by its nurses, arrived at Torokina and was able to open for work on 10th January. The 109th C.C.S. had also sent a light section for temporary attachment to the 11th Field Ambulance, and supplied two surgical teams. In the forward dressing stations the combination of tentage with semi-extemporised buildings had proved most practical and useful. The whole area was covered with dense jungle, mostly tall swamp oak and other high timber covered with creepers. Notwithstanding the difficulties the ground was cleared and huts of bush timber erected and covered with sisalkraft, each accommodating thirty folding cots. An American pyramidal tent was used as a theatre, with an adjoining oblong tent for resuscitation.

Up to the date of relief of the 29th Brigade the battle casualties were as follows:

	Officers	Other Ranks
Killed	2	32
Wounded	6	85
Wounded in action, remaining on duty	2	15
Died of wounds		6
Total	10	138

The surgical needs of the forward areas were provided by teams, and patients sent on to the base area were cared for either in the 109th C.C.S. or the 2/1st A.G.H. This was in conformity with the general arrangement that casualties from the northern sectors were sent to the 106th C.C.S. and those from the southern sector to the A.G.H. through the 109th C.C.S. Lieut-Colonel J. O. Smith, senior surgeon of the force, pointed out anomalies arising from this arrangement, which was designed to cover the period prior to the full establishment of the hospital. Now that the hospital was in full tide of work it accepted the whole responsibility of the care of casualties passing through the 109th C.C.S. and surgical work in the 4th Base Sub-area. Casualties from the northern sector, however, in some instances remained in the 106th C.C.S. only a mile away from the A.G.H., until ready for return to their own units, or transfer to a convalescent depot on the mainland. The result of this was an inconsistency which allowed casualties from one brigade area to be treated in a C.C.S., and those from another brigade area to be treated in a general hospital. The D.D.M.S. met the position on 20th January by directing that all battle casualties be sent to the 2/1st A.G.H., regardless of the sector from which they had been received. Smith wished to have the principle recognised that certain types of injury were better not to be retained in forward areas longer than could be helped. He suggested that compound fractures

of the extremities could usually be evacuated in forty-eight hours. He further pointed out that long-term cases should not be held in the 106th C.C.S., since the two specialist surgeons had to alternate between the C.C.S. and the surgical team at Soraken.

FURTHER ADVANCES

Jaba River-Mosigetta. When the 29th Brigade was relieved by the 7th Brigade on 23rd January, the roles of these formations were exchanged, so that operations could be continued inland as well as along the coast. The capture of Mosigetta was an important objective of the 7th Brigade, for here the Japanese maintained their line of communication with the first of a series of garden areas. Control of that part of the coastal area running from the mouth of the Puriata River to Motupena Point was also desirable, and the time for action was appropriate, for this locality was, according to information, lightly held. The 2/8th Commando Squadron now had the role of securing and holding the crossing of the Puriata River south-east of Barara. The light section of the 11th Field Ambulance moved out to serve the 61st Battalion in their advance from the Jaba River to Mosigetta. Kupon, the first important point off the Jaba River track, was entered without opposition and the position was consolidated.

On 16th February Mosigetta was entered by the Australian battalions. The 25th Battalion moved across through the deep swamps near the Tavera River so as to make contact with the 61st Battalion. Their patrols met near the junction of the Tavera and Konua Rivers, after encountering little Japanese resistance. During these actions there was a shortage of supplies, but this problem was solved by the combined use of air-dropping, carriage by water-craft, and by jeeps, for which a corduroy track was laid as the advance progressed.

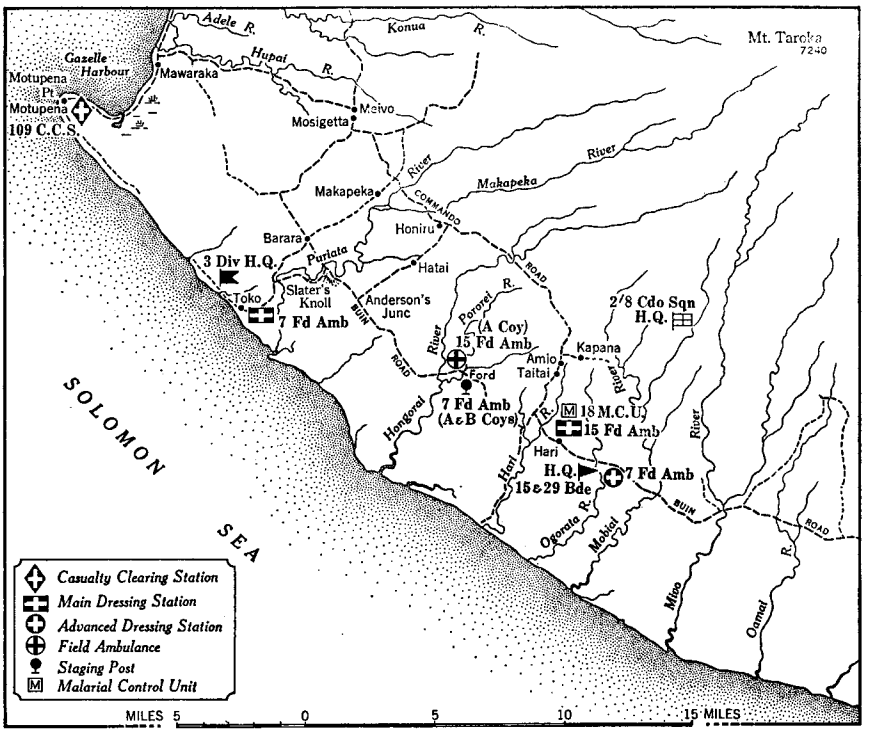
Mawaraka-Mosigetta. After encountering the enemy on 3rd February, the 9th Battalion realised that the enemy's opposition was part of a rear-guard action. On the 9th February, with the help of artillery, a company of the battalion secured the Hupai River crossing, and advancing along the river made contact with patrols of the 61st Battalion on the 17th at Meivo just north of Mosigetta. These two battalions continued patrolling in the neighbourhood of Mosigetta until a few days later they cleared this garden area of the enemy.

Motupena-Toko area. A company of the 25th Battalion which had landed by barge on the south coast of Motupena Point continued down the coast with only slight opposition and reached Toko on 3rd February. Reinforcements from the battalion were brought in to Toko by barge on the 12th, 20th and 22nd. After the initial landing at Toko, an advance was made inland towards Barara. South of this point strong enemy opposition was encountered, but Barara was occupied on the 23rd. Battalion headquarters was set up here and air-dropping of supplies was begun. Patrols were actively engaged from Toko southward across the Puriata River and were encountering Japanese parties in the garden area.

MEDICAL ARRANGEMENTS

The accomplishment of these objectives involved two movements inland and one along the coast, and to meet the problem of a three-fold evacuation line an M.D.S. was kept at Tagessi with a surgical team until casualties could be brought through Mosigetta to Mawaraka by the 11th Field Ambulance. The 7th Ambulance kept an A.D.S. at Tagessi, which was used for evacuation of casualties in the forward divisional area. On 16th February the M.D.S. of the 11th Field Ambulance was closed and reopened at Mawaraka.

To serve the inland advance on Mosigetta, "B" Company of the 11th Field Ambulance, with a surgical team attached, opened at Meivo on the



19th. As the 25th Battalion moved along the coast, a light section was established at Motupena Point. "A" Company of the ambulance came in by barge to Toko on the 27th to establish an A.D.S. for the troops in that area. At the end of February a light section of the 109th C.C.S. took over the surgical duties of the M.D.S. at Mawaraka and also provided a surgical team for the A.D.S. at Toko.

Puriata River Actions. The rapid Australian advance in three lines had delayed enemy preparations for the defence of the Puriata River, and it was realised that there must be a strong enemy force across the river

which was expected to defend the garden area strenuously. The enemy was known to be constructing defences along the Buin Road, which was one of the two main axes of the advance plan towards the southern end of the island. So far, the last part of the advance to the Puriata River had committed most of the 7th Brigade and had needed all the resources of the transport system. The tactical plan provided for the maintenance of a jeep road and a three-ton road which proceeded *pari passu* with the general advance. The effect of heavy traffic and bad weather in causing deterioration of these tracks was apparent during the recent engagements.

The 61st Battalion continued to advance, and on 6th March reached the Puriata River near Makapeka. At the same time the 25th Battalion proceeded from Barara along the Buin Road and after seizing the west bank of the Puriata River on 27th February, crossed it on 4th March and increased the depth of the position by taking Slater's Knoll.

The light section of the 109th C.C.S., which was doing the theatre work at the 11th Field Ambulance M.D.S., moved into the Mawaraka and Motupena Point area in expectation of the ambulance move to Toko. In addition, the C.C.S. was supplying surgical teams to the two A.D.Ss. These teams worked with only half the usual establishment. The C.C.S. supplied both surgeons and the equipment and orderlies for one team; the field ambulance supplied equipment and orderlies for the other. There was no question of the value of these light surgical teams as proved by experience on other fronts, and there was no doubt that the reduction of travel time between a surgical team and wounded men saved many lives.

The plan for continuing the advance was to secure the area between the Puriata and Hongorai Rivers. In the first phase, two companies of a battalion would move independently, one on a native track, the other on the main Buin Road. After this a rapid movement to the Hongorai River was planned for the 25th Battalion. This began on 11th March; both companies reached their objectives without making contact. Evidence of extensive Japanese movements was found, and in view of this, a striking force of a brigade group with tanks and artillery would be necessary, with the 15th Brigade Group in reserve.

ACTION AT SLATER'S KNOLL

From 17th March the Japanese forces became aggressive, and on the 19th the 25th Battalion made an attack along the Buin Road. Here "B" Company captured a strongly defended position by hand to hand fighting. Part of the battalion's headquarters company held the high Slater's Knoll, and other companies the area near Anderson's Junction, where the Hatai track crossed the Buin Road. Though these features were not significant of themselves the Japanese were well aware of the strategic importance of these junctions, leading to the twin axes of the Australian advance and the northern part of the southern sector of Bougainville. Heavy rain had been falling, not only flooding and distorting the rivers and their crossings, but ruining the made tracks, so that in places only native transport could bring up supplies. On 28th March the culmination came with

an enemy counter-attack on Slater's Knoll but the 25th Battalion troops stood firm in the face of two night assaults. Heavy fighting ensued during the next few days, and a company attack with a troop of tanks of the 2/4th Armoured Regiment disorganised the enemy, and cleared them from the area, inflicting heavy losses. The Australian casualties were 25 killed and 90 wounded, while known enemy casualties numbered 130 dead and many wounded.

On 29th March a general offensive was launched by the enemy on the region of the Puriata River, and Barara was also attacked and a road block established. Strong opposition with heavy fire and hand to hand fighting dispersed these assaults, and tanks were brought up along the coast by barge, while strong defences were established. Japanese threats on Toko were abandoned in a final wild attack on Slater's Knoll, which was repulsed by steady fire with heavy enemy loss. This final action was launched on 5th April at five in the morning, but the result was disastrous to the Japanese: 292 dead were buried out of an estimated strength of 1,100 committed to this attack. Coincident enemy activity flared up inland north of the Puriata River, but this and other diversionary attacks ended in failure.

The 9th Battalion now assumed responsibility from the 61st Battalion as from the last days of March.

A light section of "B" Company of the 11th Field Ambulance established a medical staging post at Barara. This was necessary for the evacuation of casualties from the 61st Battalion and the 2/8th Commando Squadron, after the line of communication between Mosigetta and Mawaraka had been closed. The A.D.S. at Meivo remained open until the position had stabilised sufficiently to give a secure line of evacuation through Barara. The ambulance which had closed its M.D.S. at Mawaraka and opened at Toko on 22nd March remained there during this engagement. Owing to difficulties arising from tactical considerations and transport, it was not always possible to site the M.D.S. or an A.D.S. as far forward as was medically desirable. The solution of this problem lay in a more extensive use of light sections, which could be gradually built up to the status of a full A.D.S. with the attachment of a surgical team as early as was practicable.

Lieut-Colonel J. M. Blair had been acting as A.D.M.S. in the absence of Colonel Wallace, but now resumed his command of the ambulance. On 2nd April "B" Company closed the A.D.S. at Mosigetta and took over the M.D.S. at Toko. In order to reach the M.D.S., the personnel had to walk from Mosigetta to Mawaraka, thence by barge to Motupena Point and on to the M.D.S. by vehicle. A few days later the road from Mawaraka to Toko was opened; evacuation was then by motor ambulance to Motupena Point, where patients were loaded into barges, which could not land at Toko by reason of an unfavourable beach formation at that spot. By trans-shipment to motor launch at Gazelle Harbour the patients were then taken to Torokina to the 2/1st A.G.H. This journey took eight hours.

By direction of the 3rd Division, the 15th Brigade began to relieve the 7th on 13th April; this relief was to be gradual to permit regrouping of units. The two-pronged advance proceeded as before, with one battalion supported by tanks each following the two main routes and one battalion in reserve. These routes were the Buin Road and a northern track running roughly parallel with it known as the Commando Road. The 11th Ambulance had the task of clearing casualties for the 7th Brigade till 13th April, and then the 15th Brigade when the 24th and 58th/59th Battalions took up positions along the Buin Road in front of Slater's Knoll.

ADVANCES ALONG BUIN AND COMMANDO ROADS

On the 17th, the 24th Battalion made contact with the enemy at the Hatai-Buin Road junction. Although the enemy had strong defence positions, the battalion reached the Hongorai ford on 7th May.

Medical arrangements for this action provided for jeep ambulance and native carriers from the R.A.P. to the light section. Two motor ambulances were available in case of heavy casualties which fortunately did not occur. An advance party of the 109th C.C.S. arrived at Motupena Point to prepare a site for the main body of the unit, in a position convenient to a safe anchorage with a good beach. By 20th April the C.C.S. was staging casualties from the M.D.S. at Toko to the 2/1st A.G.H. at Torokina.

The 15th Field Ambulance, under command of Lieut-Colonel D. W. Brummitt, closed its headquarters at Torokina on 27th April and prepared to establish an A.D.S. near Shinru Creek between the Buin Road and Toko. A road fit to take three-ton vehicles was almost through to this site, where the M.D.S. was expected to be in full tide of work in about three weeks. A change-over with the 11th Field Ambulance was then planned. This unit had completed its important task of covering the needs of the 7th Brigade and, for a short time, the 15th Brigade.

Meanwhile the 9th Battalion was continuing its advance along the Commando Road to the Hongorai River, and was relieved by the 57th/60th Battalion by the 3rd May. The 11th Field Ambulance M.D.S. at Toko closed on 7th May and on the same day the 15th Field Ambulance opened there. Major D. F. Lawson from the 2/1st A.G.H. was attached to the ambulance as surgeon. The evacuation plan at this date comprised the use of jeep ambulances stationed at the R.A.Ps. of the 58th/59th Battalion on the Buin Road and the 57th/60th Battalion on the Commando Road. Thence casualties went to the A.D.S. under escort during the night hours because of enemy activity. Jeep ambulances took casualties to the motor ambulance post at the three-ton roadhead. They usually arrived at the M.D.S. within four hours of wounding, and after treatment, were taken from the M.D.S. by motor ambulance to the 109th C.C.S. at Motupena Point.

The 15th Brigade now had the immediate task of clearing the Hongorai River with a long-range plan of securing a line from the Hari River to Kapana by a simultaneous advance along the Buin and Commando

Roads. Following a period of active patrolling by the 24th and 58th/59th Battalions and after a week of heavy air and artillery attacks on the enemy positions, a general attack opened on 20th May. Supported by tanks, the 24th Battalion crossed the ford at the Hongorai River and cut the Buin Road on each side of the Pororei ford. By the 22nd, with the help of artillery and air bombardment, Egan's Ridge, a strong enemy position was occupied, and on the following day the Buin Road was cleared south of the Hongorai ford by both battalions.

A crossing was made over the Hongorai River by the 57th/60th Battalion on the Commando Road, and contact made with an armoured patrol of the 58th/59th Battalion moving across from the Buin Road on the 28th. The medical care for the 57th/60th Battalion was given by the R.M.O., Captain J. S. Jeffries, and a light section of the 15th Field Ambulance, with surgical and holding facilities as far forward as possible and evacuation was carried out by jeep ambulance or native carriers to the nearest A.D.S. In preparation for the Hongorai River attack, Captain F. L. Sharp of the 15th Field Ambulance had established an A.D.S. at Dawe Creek on 17th May. This dressing station had a twenty-five bed ward and a theatre with a resuscitation room which on completion became the ambulance M.D.S. on 22nd May. Major B. R. Morey and Captain D. L. Graham arrived at Dawe Creek with their surgical team from the 109th C.C.S. to work at the M.D.S. The A.D.S. of "A" Company moved forward with the advancing battalion to Kekro Creek. One company of the 7th Field Ambulance had moved into the 15th Field Ambulance site at Toko to permit the concentration of this unit at Dawe Creek. The responsibilities of the 7th Ambulance post at Toko included evacuation from the divisional maintenance area, and the line of communication area forward of Toko as far as Slater's Knoll. The 18th Malaria Control Unit was sent forward to Dawe Creek at the end of May so as to coordinate preventive measures in the 15th and 29th Brigade areas. The control unit worked here, and as the infantry moved forward, arranged for the units in the rear to take over the organisation so that the malaria control unit could again concentrate on forward work in the battalion areas.

On 1st June Hammer Road, connecting the two axes of advance, was open for evacuations from the 57th/60th Battalion to the A.D.S. which opened at Pororei. Here Morey and his surgical team were prepared to operate on all casualties whose condition would be prejudiced by a further journey to the M.D.S. The 58th/59th Battalion resumed the advance along the Buin Road on 2nd June, by the 4th had reached Peperu River and three days later was occupying the west bank of the Hari River. At the same time the 57th/60th Battalion, advancing along the Commando Road cleared the track across to the Buin Road from Amio.

Some anxiety had arisen concerning malaria in the 42nd Battalion which was guarding lines of communication in the rear of the advancing troops. The commander felt sure that the considerable rise in M.T. malaria during the first week in June was due to omission to take atebrin, and he proposed to take disciplinary measures if necessary.

The task now assigned to the 15th Brigade was the securing of the line of the Mivo River. To gain this objective there were three river crossings to be made, over the Hari, Ogorata and Mobiai Rivers. To carry out this operation, one battalion, the 58th/59th, advanced along the general line of the Buin Road, while the 57th/60th Battalion simultaneously advanced eastward to cross the Ogorata River, then turned south to cut the Buin Road. Meanwhile one company of the 57th/60th Battalion moved out on an outflanking sweep to the line of the Mivo River, and the 24th Battalion carried out diversionary movements in the south.

The installations of the 15th Field Ambulance covered the operations with their M.D.S. at Dawe Creek, and an A.D.S. with a surgical team at the Pororei River with the addition of two staging posts. As the A.D.M.S. wished the 15th Field Ambulance to remain in the Buin Road area, a party from the 7th Field Ambulance was detached to care for the 57th/60th Battalion.

Hari River to Ogorata River. After four days' bombardment, which included air strikes, and persistent artillery and mortar fire, the attack began on 13th June. Two companies of the 58th/59th Battalion crossed the river to the north of Hari 3 crossing, and unopposed, went on to cut the Buin Road at another crossing to the south. Further troops crossing the river found the previously strong enemy force near the Hari 3 crossing had withdrawn. Difficulties with tanks, and the disablement of a leading tank by enemy fire, caused delay in the advance, but on the 15th the forward company of the 58th/59th Battalion reached the Ogorata, and crossed this river next day. On the same day, two companies with strong artillery support disposed of the enemy on the eastern bank of the Hari River and cleared the road to the Ogorata ford. On the 16th, one company after crossing the river met the leading troops of the 57th/60th Battalion which was advancing from the north. The men were on the whole well, but Jeffries reported an increased incidence of florid skin disease, chiefly tinea, caused by the lack of change of clothing and washing facilities, especially during recent actions.

Lieut-Colonels C. H. Selby and R. F. Jaboor from the 6th Division in Aitape-Wewak, New Guinea, visited the M.D.S. at Dawe Creek and forward areas to investigate the difference in the malaria rates for various forces and areas, and the methods adopted for malaria control. This visit was part of an enquiry made on behalf of the commander, 6th Division. Further references to their findings and conclusions are made in the chapter dealing with Aitape-Wewak.

A new M.D.S. was now needed, and a site was chosen west of the Ogorata River, the old M.D.S. at Dawe Creek being taken over by part of the 7th Field Ambulance. As before, two surgeons were employed, Majors Morey and T. E. Wilson, and until the M.D.S. could move up with full facilities, a half surgical team worked at the A.D.S.

Comfort and adequacy of nursing procedures were assured in the 15th Field Ambulance by the carrying of fourteen surgical beds, and the portable X-ray outfit was installed at the M.D.S. The A.D.M.S. found

that this arrangement gave better results in proportion to the men and stores needed, than by the employment of a light section of a C.C.S. It must of course be remembered that the particular features of the campaign, especially with regard to the type of transport used, were considered in implementing this plan. The methods of evacuation at this point in the campaign comprised native carrier teams, jeep ambulance, motor ambulance, water ambulance craft and Auster aircraft. Problems arose, of course. For example, the wear and tear on the jeeps on rough corduroy roads was considerable, and the absorption of these vehicles for casualty transport reduced the amount of transport available for other purposes in the field ambulance. It was not always possible to pool jeeps for movement, as ambulance units sometimes moved together. The C.C.S. at Motupena Point acted as a stationary hospital of 200 beds: it staged patients to the general hospital.

The supply of rations was excellent. When the strain on the usual channels of lines of communication became severe air supply came to the rescue. The 2/8th Commando Squadron received fresh rations by air almost every day. This factor helped greatly in maintaining a high standard of health.

Ogorata River to Mivo River. The 57th/60th Battalion resumed its advance on 17th June along the Buin Road towards the Mobiai ford. A Japanese gun, firing from a strongly entrenched position, disabled the leading tank and held up further advance for several days. By successful outflanking movements one company reached the Buin Road in the vicinity of the Mobiai ford, but on the 23rd other companies were still heavily engaged. The next day heavy artillery and tank attacks forced the enemy to withdraw, and on the following day the road was clear from Ogorata to the Mobiai Rivers. Meanwhile the 24th Battalion was engaged in diversionary actions on the northern flank.

In order to take advantage of the speed with which the brigade's patrols were making outflanking movements, prompt advance to the Mivo River was highly desirable. Accordingly, plans were made to this end during the last week of June. On the 26th the 57th/60th Battalion crossed the Mobiai River, while the 24th Battalion came through and made ready for an attack to the south on the Buin Road, which was successful on the 29th. Concurrently the 57th/60th Battalion after a sharp engagement with the Japanese, also reached the Buin Road. After carrying out diversionary activities to the south, the 58th/59th Battalion forced a crossing of the Mobiai River and secured it. Heavy rain had been falling for days, and the roads were rapidly deteriorating. On the 29th June the 15th Field Ambulance experienced great difficulty in maintaining jeep traffic. The road between the M.D.S. and the Ogorata River became impassable: the brigade arranged for native carrier teams from the ford. However the evacuation scheme was working well, though the first stage took up to six hours. A car post at the R.A.P. of the 58th/59th Battalion helped to transport all but the seriously wounded. Captain L. W. Middleton, the R.M.O. of this unit, stressed the importance of having facilities for resus-

citation at the aid post. Serum was always obtainable, and blood also, as a rule, by calling on a mobile blood bank in the headquarters personnel.

The 15th Brigade had now had a strenuous period of activity, and on 30th June the 29th Brigade commenced to relieve them. Two companies of the 7th Field Ambulance were ready at the Pororei River to cover the movement of the 29th Brigade when this force should cross the Mivo River. By this arrangement the 7th Field Ambulance provided service along the line of communications to the C.C.S.

During the first week of July the Japanese made a number of vigorous attacks across the Mivo River, and attempted to push back the Australian forces on the west bank and along the track. All these assaults were successfully repulsed, and the battalions began patrolling on the eastern side of the river.

By 9th July the 15th Ambulance had provided a medical staging post along the Buin Road forward of the Mobiai River. This was designed to be developed as an A.D.S. with a surgical team for the action proposed in the crossing of the Mivo. However, the post was found to be too exposed to the enemy and was withdrawn.

The weather continued to be extremely bad, with incessant rain. Owing to the poor condition of the roads beyond the Mobiai River no patients were received by the M.D.S. for three successive days. On the 13th four patients arrived on stretchers brought by native teams, and ten walking patients were brought by returning ammunition jeeps. From this time onwards torrential rain restricted all but minimum activities. The road forward was almost impassable, and transport of wounded by jeep impossible. Casualties were still arriving, by native carriers, tractor trains, jeeps and all combinations of transport. On 20th July supplies for the field ambulance were successfully dropped from the air. By the 22nd all the rivers were in flood. The Mivo rose to seven feet at the ford, running swiftly, and the Mobiai was almost as deep and fast. Over twenty inches of rain fell on twenty-six days during July. Patients bound for the M.D.S. of the 15th Ambulance at Pororei were taken through washaways by the help of trucks provided by the engineers.

Flooding of rivers along the Buin Road caused many difficulties in evacuation of patients. Most of the bridges were rendered unserviceable in some way, and the bridge over the Hongorai was destroyed. A washaway on the beach road between the 7th M.D.S. at Toko and the 109th C.C.S. at Motupena Point necessitated the ferrying of patients across the creek to ambulances on the other side.

The 15th Field Ambulance war diarist summed up the medical events of the month as follows:—

> This month has been marked by the bogging down of all operations owing to the rain and road conditions. As a result little movement of medical posts has been required; casualties and sick have been slight. Owing to the wide infiltration of small enemy bodies, bigger guards and more defensive positions have been required. The M.D.S. has been enclosed within a wire perimeter with four guard-posts; a Bren gun has been acquired to increase fire power and some booby traps set each night outside the wire.

The time was now approaching when the Japanese were facing surrender, and their unconditional capitulation on 15th August brought hostilities to a close. The campaign on Bougainville was far from static. The force under the command of II Corps had three sectors in which active fighting proceeded during the greater part of the period, and for part of the time the services of one brigade were needed for an unusual perimeter defence in a chain of islands surrounding the larger island member of the group. The Australian forces carried out a well-conceived and well-supplied campaign, and, although no final decisive result was won, largely owing to the colossal hazards of the weather, the military position was stabilised after severe loss had been inflicted on the enemy.

Medically the campaign offered many difficulties and problems of considerable magnitude. An attack consistently pressed on a narrow front, ever advancing over difficult country, placed the obligations of medical and surgical service on detachments of field ambulances often slender in size, who had to show their skill in carpentry as well as surgery. Endemic disease threatened the force to some extent; in particular, malaria and disorders of the skin, but resource and a practical approach, especially with regard to the use of suppressive atebrin, solved these problems satisfactorily.

HEALTH DURING OPERATIONS

The battle casualties for the whole campaign numbered 39 officers and 472 other ranks killed; 82 officers and 1,478 other ranks wounded. The ratio of battle casualties to sick was 1 to 3.8. The most striking feature of the sickness suffered was the preponderance of affections of the skin, which accounted for 21.8 per cent of the total. Malaria produced 345 cases in the campaign period, the weekly rate being 0.73 per 1,000. The average strength of the force was 12,220 and only 100 reinforcements were brought in.

Malaria. D.D.T. was used as an offensive weapon against the adult mosquito. In December 1944 a supply of 200 pounds was obtained from the United States Army, and was used constantly until it became an A.S.C. issue. Suppressive atebrin was the standby of preventive measures. In semi-static units seven tablets of 0.1 gramme per man per week sufficed to suppress the disease, but troops in battalions in contact with the enemy were found to require nine to ten tablets a week to allow for any element of break-down. Such element might be due to the conditions of battle, or to the occasional frailties of human nature. Under special conditions men on patrols were taking, under instruction, three tablets a day.

A field test was carried out and the results from forty-five units were consolidated. This showed that twenty units had not varied their atebrin dosage, officially or unofficially. These were all small units, with strength under 200, and were semi-static in type. Five units took extra atebrin after reference to the divisional headquarters, and five of these also took extra dosage unofficially. During the preceding six months, twenty units

had from time to time taken unofficial increases in atebrin. There were nine battalions in the formation, and seven of these took extra atebrin unofficially. Infantry battalions with the exception of one which had only three cases of malaria, took extra atebrin for a period of at least seven days. The conclusions reached from this information were that men in contact with the enemy at some time or other took extra atebrin; it seemed as if this was necessary for some individuals, in order to maintain an effective blood concentration under service conditions. A dosage of nine to ten tablets a week was found to be effective in suppressing malaria in combat troops, and in preventing mild infections from reaching clinical level. The divisional report in summarising these findings could not state whether seven tablets a week was insufficient under certain service conditions, or whether the larger dose merely ensured taking or absorbing a minimum of seven tablets. The latter was considered more probably true. This report further pointed out that even under the controlled conditions of Cairns the human factor could not be disregarded. To this may be added a comment, that there are reasons for believing that the amount of extra atebrin unofficially taken by officers, in particular, was underestimated. In a discussion on the role of atebrin in the prevention of malaria Major G. H. McQueen, the D.A.D.H., pointed out that some medical officers were sceptical of the results because of their ignorance of the Cairns investigation. They sometimes blamed the "breaking through" of the atebrin barrier by the parasite when the real cause might be carelessness, or the breaking down of precautions under stress. In January 1945 the G.O.C. Corps ordered that all men contracting malaria were to be charged with failure to take atebrin.

The malarial rate in the 3rd Division was low; in June 1945 it was 0.4 per 1,000 per week. The active work of the malaria control unit played an important part in this. Liaison was established between the Allied control units immediately after the 18th Malaria Control Unit landed on Bougainville, and this ensured that existing control measures were continued in the base area and on the outlying islands where troops were stationed. When a sharp increase in the malarial rate caused a rise to 1.3 per week the dose of suppressive atebrin was raised to two tablets daily for one month. Some slackness had been observed, and the D.D.M.S. thought the value of the increased dose lay in the assuring that the correct dose was actually taken. He suggested that a better method of using a temporary higher dose would be to order five tablets daily for two days, then to revert to the usual dose after a sufficient elevation of the blood level had been achieved.

Spraying with D.D.T. was found most effective in destroying adult mosquitoes, and the pyrethrum "bombs" were of great value for local use. The higher rate recorded in the 3rd Division was 2.5 per 1,000 per week up to January 5th, the 7th Brigade demonstrated that a "nil" incidence could be attained even on active operations.

Typhus Fever. At the beginning of operations on Bougainville a mild type of scrub typhus was not uncommon. Most of the cases came from

two river areas, the mouth of the Laruma River and near the Jaba River. On 9th January the A.D.M.S. stated that no cases occurred after full anti-mite precautions were taken. These included the application of anti-mite fluid to clothing in the prescribed way, and the use of blankets treated so as to impregnate them with the fluid. In June more severe cases appeared in the 2/1st A.G.H., and during the next few months a serious type of infection was seen. The most severe cases came from a small island off the north-western tip of Bougainville known locally as "Death Island". It was declared out of bounds.

Dengue Fever. Aedes Scutellaris was prevalent in places, for example in the base area. From the beginning, care was taken to lessen contact between men and the vector mosquitoes. Some doubt was expressed whether some of these infections were in fact dengue, but the variable symptomatology of this disease is often deceptive. In January 1945 cases of epidemic polyarthritis were seen, conforming to the description of Lieut-Colonels J. P. Horan and J. H. Halliday in the Northern Territory. It is possible that some of the "? dengue fever" cases may really have been due to this infection.

Dysentery. The greatest number of patients under treatment for dysentery at one time was fifty-four, but never was there a serious outbreak, and during the last three months of the campaign there was a steady drop in the incidence, owing to improved hygiene.

Ankylostomiasis. The prevalence of hookworm in this theatre of war was notable and was associated with a heavy degree of infestation. As the troops moved forward into other areas the incidence lessened, and acute cases were not seen.

During March an investigation was carried out on the prevalence of hookworm in the 58th/59th Battalion. Middleton, the R.M.O., sent eighteen men to the 15th Field Ambulance for investigation into a state of malaise suspected to be due to hookworm. Fourteen of these men were found to be passing ova, and 418 soldiers were examined at the 2/1st A.G.H. Of these 117 were found to harbour the ankylostoma, and of a total of 521 investigated at the 2/1st A.G.H. and the 109th C.C.S., 28.5 per cent were proved to have hookworm. Mass treatment was instituted in the unit lines, the men were given tetrachlorethylene and oil of chenopodium and rested for the day, no check of efficacy of treatment was possible. Very heavy infestations were discovered in some of these men: one showed 300 ova per field, but in other respects the health of the men was good.

Respiratory disease. The general hospital treated many men with a prevalent mild respiratory infection. Some instances of "atypical" pneumonia occurred; these were not of the severe type of which some instances were seen among Allied troops in Australia, but were thought to be of virus origin. Investigation did not reveal evidence of influenza or psittacosis. Upper and lower respiratory tract infections were prevalent for a time among the natives, among whom cerebro-spinal meningitis was also seen. An outbreak of tonsillitis due to haemolytic streptococci

occurred among the troops during the June quarter, an unusual episode in the tropics.

Infective polyneuritis occurred in the force in small numbers, mostly of the type affecting isolated muscle groups. These resembled those seen on other fronts.

Infective hepatitis occurred in the 3rd Division just as in other formations during the island campaigns. The clinical course was of usual type, but two men died from acute liver necrosis with terminal uraemia, raising the question of infective hepatitis as a possible cause.

Psychiatry. A special ward was provided for psychiatric patients. Major H. J. B. Stephens, the psychiatrist to the hospital, found that the commonest types of condition treated were acute confusional psychosis, about 30 per cent, anxiety state 25 per cent and hysteria 24 per cent. Cardiazol shock therapy enabled the patients with confusional states to improve sufficiently to permit air travel to the mainland. Only for special personal reasons was full insulin coma used. Most of the psychoneurotics were returned to duty.

Affections of the skin. The prevalence of skin affections aroused concern on all tropical fronts. On Bougainville the self-contained conditions suggested facilities for further observation or investigation. Brigadier A. L. Dawkins, D.D.M.S. II Australian Corps, requested that an experiment be carried out on the personnel of the 2/1st A.G.H. to find out whether leaving off gaiters would lessen the incidence of skin lesions round the ankles and feet. The commander of the 4th Sub-area assented to a month's trial. The preliminary examination was made of the men some two months after their arrival at Torokina, and inspections were repeated at about weekly intervals. Most of these men had been engaged in heavy work in establishing the hospital. Clinical observation indicated that skin lesions of the feet and ankles were much less frequent when gaiters were not worn, though no statistical analysis was attempted. It was also noted that lesions reluctant to heal promptly cleared up when gaiters were left off. Permission to discard gaiters was not given except for the purpose of this enquiry, and then only during daylight hours in a controlled area. In other units where opportunity offered there was no doubt felt that the avoidance of minor trauma to the skin and its exposure to the sun and air prevented many of the infected traumatic lesions common on the lower limbs. It was not suggested, of course, that traumatic factors were the only cause, or even the predominant cause of minor lesions of the skin, nevertheless the environmental conditions were not favourable to the skin. The principal conditions occurring were *pyodermia, miliaria rubra,* and fungoid infections.

Sea bathing was noted to have a favourable effect on lesions of the skin. The 15th Brigade for example, established rest camps along the beach near Toko where sea bathing was extensively practised, reducing the sick wastage considerably, especially that due to skin infections.

To the D.D.M.S's. war diary of II Australian Corps on July 1945 a report was appended on the incidence of skin conditions in that forma-

tion. This was the work of a special skin investigation committee and included surveys of the dermatological state of soldiers evacuated to hospital or while at work in their units. It was the outcome of six months' work and observation.

During this period 2,568 cases of skin disease were admitted to medical units, an average incidence of 4 per 1,000 per week. In the same period 340 patients were transferred to the mainland and 47 reclassified as "B" class, unfit for service in a hot humid climate.

The experiment tried in the A.G.H. was repeated, but no conclusive results could be obtained. Comparison with the American and New Zealand forces disclosed no tangible difference, though the New Zealanders suffered much less from tinea, but much more from abrasions infected with staphylococci. This was thought to be due to their wearing shorts.

The committee did not suggest any major alterations in the official instructions relating to skin diseases. Tinea and intertrigo continued to give a great deal of trouble, even though over-treatment was then uncommon, as its dangers were clearly understood by all medical officers. The degree of care each man paid to his skin was an important factor in skin health, and the committee felt that more effort, by inspection for example, should be made to inculcate the precautions already laid down. In chronic tinea of the feet very encouraging results were obtained by the use of copper iontophoresis as suggested by Dr E. H. Molesworth. No X-ray therapy was available on Bougainville.

The committee considered questions such as the occupation of the men and climate. The effect of climate was evident. Numbers attending the aid post of an infantry battalion for skin affections rose sharply when the unit left a cool high area and went to a hot and humid one. Fungoid infections were also discussed and consideration was given to the possible means of infection. A dermatological survey was also made of troops on the outlying islands of the Solomons Group. On Green and Emirau Islands inspection parades were carried out, and the frequency of different types of lesion was compared with that in other areas.

On the basis of the material gathered the committee submitted a technical instruction on the diagnosis and treatment of skin disease, and an administrative instruction dealing with factors of probable importance. Dawkins felt that the suggestions were perhaps idealistic but that the investigation and deliberations did positive good, as they affirmed the value of well-established principles, and stated the need for these to be translated into practical terms.

As the Pacific war was over when this document was presented for consideration, and as similar and more extensive investigations had been planned in other areas, the time had passed by for the pursuance of these plans, but the importance of the problem was reinforced, and still remains as significant in tropical warfare.

The work done by the surgical teams varied greatly in the gravity of the clinical condition of the patient, hence the high value of facilities for resuscitation and transfusion. The time elapsing between wounding

and operation varied considerably in different areas, and with the mode of transport, as has been seen in other campaign areas. Transfusion services direct from Australia to the islands were very efficient. Blood taken by the transfusion units in Australia arrived at Torokina within thirty-six hours. Compound fractures, especially of limbs, continued to be a common type of injury; so too were soft tissue wounds, but many of these needed only the routine treatment of wounds not involving other important structures.

In December the team of the 109th C.C.S. found that patients from the vicinity arrived in less than an hour, those from forward areas in two to six hours, but men wounded in the late afternoon or at night might not be seen for twenty-four hours. Gas gangrene was not of significance, owing largely to the value of prophylaxis. Penicillin was of major importance, as it helped to give that armament against infection already given in part by necessary surgical intervention, and by resuscitation. The relative danger of certain injuries such as those involving the head, the long bones or the abdomen was much the same as previous experience on other fronts had shown.

During the last five months of the operational period on Bougainville, out of 380 battle casualties, fracture of the skull occurred in 10, and of the extremities in 68. Smith had 665 surgical beds available at the 2/1st A.G.H. during this period, and the average bed state, over a time when 500 beds were equipped, was 450. As the result of experience in that unit, and after visiting officially the southern and northern areas, he reported on the technical aspects of the work. He found that the disposal of casualties was not always satisfactory, as they were sometimes held longer than was desirable in C.C.Ss. and M.D.Ss. In certain instances better results would have followed prompter disposal, as in cases of secondary suture, compound fractures, wounds involving joints, perforating chest wounds and local gas gangrene.

He emphasised that the conditions on the island were such as to allow earlier transport of casualties, and that this was not only possible but desirable. The actual organisation of surgical work on Bougainville was of course conditioned by such hazards as flooding of rivers, by the type of available transport and of forward accommodation. The mode and time of movement depended largely on these, always having regard for what was best for the individual patient.

The forward organisation owed a great deal to the pioneer work of surgeons in previous campaigns, but on this front more material help was available to the men who constructed the jungle operating theatres, and those who worked in them. The advantages of a cement floor in a theatre are obvious, and of refrigerators as far forward as an A.D.S., which can thereby hold stored blood within reach of men suffering from shock. In some areas a team could work at the M.D.S., but where the evacuation time from A.D.S. to M.D.S. exceeded two hours, and when the total waiting time of the patient was over the safe period, the surgical team was more useful at the A.D.S.

The medical officers of the 3rd Division were given such opportunities for post-graduate study as were practicable under the existing operational conditions. On 5th January a meeting was held of senior medical officers at the Headquarters of II Corps to discuss the possible facilities. The importance of basic studies was emphasised, such as physiology and pathology. Arrangements were made to hold clinical meetings at the 2/1st A.G.H. and the C.C.Ss. weekly. It was pointed out that there were difficulties in obtaining replacements for medical officers for whom a period of study in hospital was desirable. Lectures and symposia could be given at night in addition to ward rounds; a medical and a surgical round could be held weekly or on regular days. Special subjects could be covered also, such as ear, nose and throat, skin, X-ray, pathology and anaesthetics.

In his quarterly report the D.D.M.S., Brigadier Dawkins, expressed the hope that arrangements could be made for exchange of medical officers with three years' service in the field. Those who had had long experience as R.M.Os. were to be sent to field ambulances, and other medical officers might be attached to a general hospital or a C.C.S. for special instruction. A useful purpose was served by these arrangements, as the interest taken by medical officers in the practical aspects of their work reached a high level. Greater difficulties were apparent in arranging for tutorial work in the theoretical subjects necessary for higher degrees and diplomas. Though these were an immediate post-war objective for many young medical officers, theoretical lectures and even ward rounds did not evoke a very keen response. Nevertheless plans were made for post-graduate work, and if there were difficulties in carrying them out it must be remembered that by this time hostilities had ceased, and a natural restlessness arose not assuaged by educational facilities alone.

CHAPTER 14

NEW BRITAIN

AFTER the campaigns on the Huon Peninsula and in the Ramu Valley had been successfully completed, a new drive was begun under the direction of the Headquarters of New Guinea Force with the object of securing bases on the north-eastern coast of New Guinea. Further administrative changes were then made: these brought the operational headquarters up to Lae, where the Headquarters of First Australian Army took over the functions of New Guinea Force, and directed the operations of II Australian Corps. The First Army on 2nd October 1944 assumed command of all the Australian Military Forces in New Guinea, New Britain, and the Solomon Islands. Among these was the 5th Division under command of Major-General A. H. Ramsay. This division had carried the advance of the Australian troops to Madang and Alexishafen, and as far as Hansa Bay. By 13th September the greater part of the force could be withdrawn to Madang with safety, leaving a patrol base in active operation at Bogia.

Consideration of further offensive movements to the Philippines, and the possibility of Australian troops being concerned in these or in other combined operations, brought about discussions between Generals MacArthur and Blamey, with the result that General Headquarters issued a directive setting out the minimum strength to be employed in the various areas in which defence must be maintained. Thus New Britain once more came into the Australian picture, and the 5th Division with its comparatively small force of three brigades was assigned to this area. Towards the close of 1944 a small Australian force took over from the American formations which in December 1943 had landed at Cape Gloucester and Arawe, on the western end of the island. Here the Americans had captured a number of vital airfields, and had gained control of the north coast as far as Talasea and Hoskins on Kimbe Bay.

Since the Japanese had seized New Britain in 1942, parties of the Allied Intelligence Bureau had been very active in the central area of the island, and employed native armed patrols in gathering information about the enemy, and harassing them until they had been cleared from the north coast to Ulamona and the western end of Wide Bay on the south. In October 1944 the strength of the Japanese forces in New Britain was estimated at 38,000 troops (actually there were far more), and their objective appeared to be the defence of their main operational base at Rabaul. This had been built up since early in 1942, and was known to be very strongly defended in a system of underground stores and shelters. The Japanese also maintained a perimeter defence, within which they carried out extensive cultivation. The ability of the enemy to make sorties from this stronghold was severely limited by the general military position, quite apart from any possible question of policy; moreover, the

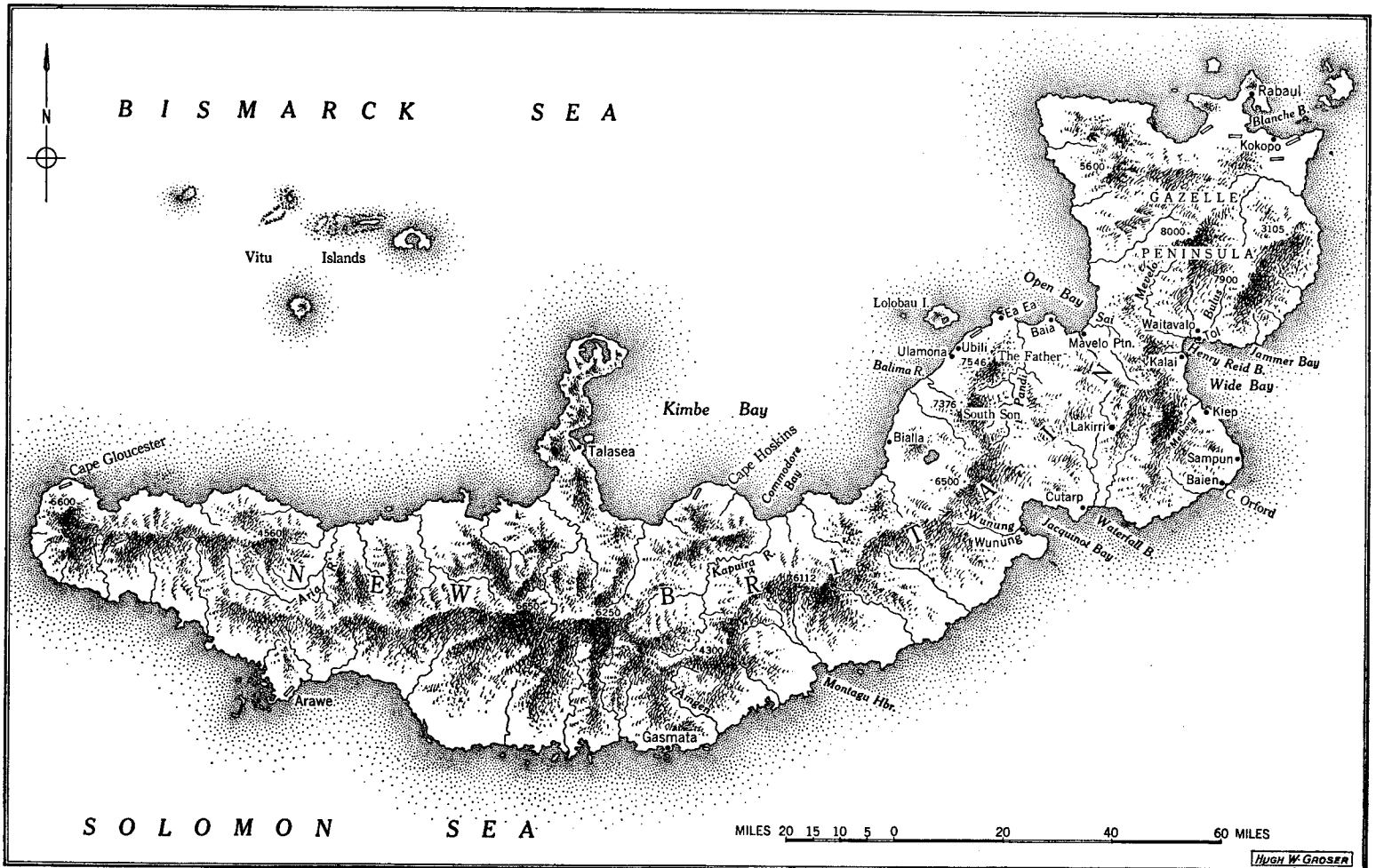
Australian division had an objective clearly defined by the Army Command. The specific task of the three brigades was to contain the enemy within a line connecting the Wide Bay and Open Bay areas. The north-eastern sector of the Gazelle Peninsula was believed to be strongly defended, but the indications were that the Japanese would not be likely to commit a large force to offensive operations.

New Britain does not exceed 50 miles in breadth at any point of its 370-mile length. It is mountainous, and has a number of high peaks some of which are actively volcanic. In the Gazelle Peninsula there are mountains of 7,000 feet elevation, and the central chain farther south rises to an almost equal height. South of Open Bay are high peaks, two of the largest being an active volcano of 7,546 feet, known as The Father, and an extinct volcano called South Son. Much of the interior of the island is rough and densely wooded, with many short but swift running rivers, numbers of which are swampy near the sea. Wide Bay and Open Bay deeply indent the coastline on each side of the narrow neck of the Gazelle Peninsula; other important areas are Talasea and Hoskins, within the expansive Kimbe Bay on the north, and Jacquinot Bay south of Wide Bay. The narrow belt between Wide Bay and Open Bay is flatter than most of the rough timbered country between coast and coast.

RELIEF OF AMERICAN FORCE

In September 1944 Jacquinot Bay was explored and a site found suitable for a divisional base: at the same time another site was discovered for a base area on the northern side, in the neighbourhood of Talasea and Hoskins. To further this end of having ready two base areas in advance of the projected movement of the division, plans were made to secure Jacquinot Bay by the 6th Australian Brigade Group (less one battalion group) in the south, and Talasea-Hoskins by the remaining 36th Battalion Group in the north. The first step was to effect the relief of the American force already in New Britain. The 40th United States Division was responsible for the safety of western New Britain, with organised defence from its headquarters at Cape Gloucester, and other defence groups at Arawe and the Talasea-Hoskins area, where a regimental combat team was stationed. A general basis for the relief was mutually agreed; this provided that the American force at Arawe would be relieved of responsibility in this area when the 6th Infantry Brigade Group arrived at Jacquinot Bay, and an Australian infantry battalion group would similarly take over the Talasea-Hoskins area on the north coast. On the arrival of an additional Australian brigade group the relief of the 40th Division would be completed.

On 7th October, a few days after Lieut-General V. A. H. Sturdee, commanding First Australian Army, had taken over the New Guinea operational area, the 5th Division, less one battalion group, was assigned the task of protecting the 5th Base Sub-area at Jacquinot Bay, and preventing any infiltration of the enemy towards the western part of the island. Similarly the 36th Battalion of the 6th Brigade was to prevent


N
BISMARCK SEA
SOLOMON SEA
Vitu Islands
Cape Gloucester
Talasea
Kimbe Bay
Cape Hoskins
Commodore Bay
Arawe
Gasmata
Montagu Hbr.
Lolobau I.
Ea Ea
Open Bay
Baia
Sai
Ulamona
Ubili
The Father
7546
Balima R.
Mavelo Ptn.
Waitavalo
Kalai
Henry Reid B.
Jammer Bay
Wide Bay
Kiep
7376
South Son
Lakirri
Bialla
Sampun
Baien
C. Orford
6500
Cutarp
Wunung
Jacquinot Bay
Waterfall B.
Rabaul
Blanche B.
Kokopo
5600
GAZELLE PENINSULA
8000
3105
7900
Mavelo
Bulus
Tol
Kapuira R.
6112
6250
4300
Arg
MILES 20 15 10 5 0 20 40 60 MILES
HUGH W. GROSER

New Britain

the Japanese from infiltrating along the north coast, east of Cape Hoskins. This northern area had already been developed by the American forces; detachments of various technical kinds were attached to the Australian battalion, including part of the 6th Field Ambulance, which was commanded by Lieut-Colonel S. W. Bryan. Arrangements were made for the establishment by Captains J. L. Dunstone and J. M. Banks of "A" Company of a 50-bed A.D.S. at Cape Hoskins, and to this a surgical team was attached from the 2/7th A.G.H., comprising Major E. A. Hedberg, Captain G. Fitzgerald and four O.Rs. Medical officers also gave necessary care to the natives in the area, numbers of whom needed treatment for yaws. The A.D.S. was ready on 11th November and on the 13th the relief of American troops at Hoskins was complete. Shortage of shipping made it necessary to move the 36th Battalion in two stages; one on the 8th and the other on the 31st October. Transport for these moves was obtained from Madang, Lae, Darwin and other parts of Australia.

On the southern side of the island an advance party from Lae landed at Jacquinot Bay without any opposition. The 14th/32nd Battalion arrived on 4th November with "B" Company of the 6th Field Ambulance; on 27th November complete operational responsibility for New Britain passed from the 40th United States Division to the 5th Australian Division. The original plans for movement provided for coordination of the arrival of the various defensive units, but exigencies of shipping prevented this, and the organisation had to be altered and extemporised for some time after the landing of the early elements of the force. Concentration of the whole division was completed in mid-April 1945.

As soon as the American forces were relieved, the next step was to ensure the security of the bases on the north and south coasts. It was then necessary to make contact with the Japanese, and to advance to the line running across the narrow waist of the island between Wide Bay and Open Bay. More detailed planning was not immediately practicable, but Headquarters First Australian Army directed that the division begin its task with offensive patrolling, and carry out small sorties within the resources available at the time.

As the military operations were to be made on a restricted scale, with a front not exceeding one brigade, the medical dispositions were correspondingly reduced, and the forward work was the responsibility chiefly of one field ambulance. Until the Wide Bay-Open Bay line was closed to the enemy, the northern and southern coastal sectors were separate and distinct, and for purposes of description they are also most simply dealt with independently.

ON THE NORTH COAST

At first there had been little activity in the Open Bay area; the lack of enemy opposition was, however, deceptive. Patrols of the 36th Battalion had explored the north coast up to Ea Ea in barges without sighting the enemy.

The strength of the Japanese in the area was increasing; and on 21st November a strong enemy party moved from Ea Ea by barge to Ulamona.

Patrols from the 36th Battalion began moving forward to meet this threat, and an additional company was brought up to help. Patrols from Bialla to the Balima River made no contact with the enemy, and found early in January that the Japanese had withdrawn beyond the Pandi River. The medical services for these patrols were supplied by a light section of the 6th Field Ambulance Company. At Hoskins the 36th Battalion maintained only a minimum force, sufficient to defend the airfield; the remainder of the group was kept at Ea Ea. It was not practicable to keep a larger force at Bialla, which was on the open sea, and the problem of maintaining supplies was considerable. A company of the New Guinea Infantry Battalion moved up to Ea Ea, and patrolling in the volcano area, The Father, still met no enemy until 27th January when a Japanese patrol was encountered near Mevelo plantation. In February the Japanese made strong attacks on the Australian positions between Baia and Pula Pula Bay, but again withdrew. Later in the month a strong force attacked Australian patrols near the mouth of the Sai River, and here the enemy continued the same tactics, withdrawing when subjected to counter-attacks.

The A.D.S. at Hoskins was now closed, and re-opened at Nantambu, but an evacuation post was retained at Hoskins for handling casualties to Lae from forward areas. The route of evacuation was from the 36th Battalion R.A.P. by barge to the A.D.S.; this took one hour, and eight hours more by barge to the Hoskins post, provided the patient's condition enabled him to stand this journey. Thence the wounded were sent to the 2/7th A.G.H. at Lae by plane or ship. It was found wiser to keep seriously ill men at the A.D.S. rather than expose them to the strain of a tiring journey in unsuitable transport.

The position in March on the northern coast was reasonably stabilised; medical arrangements were satisfactory; adequate attention and transport could be obtained independently of the remainder of the force. Endemic disease was of some importance but caused no serious inroads on manpower. During April "A" Company and a detachment of "B" Company of the 4th Field Ambulance, under command of Lieut-Colonel A. H. Gee, were expected to relieve "A" Company of the 6th Field Ambulance. Shipping was not available for the movement so it was necessary for the 4th Ambulance party to march across the peninsula from Tol to Nantambu. After arrival they took over the duties hitherto performed by the detachment of the 6th Field Ambulance.

ON THE SOUTH COAST

The landing on 4th November in Jacquinot Bay was planned with due precaution, with protection from the navy and air force, but it was unopposed. The 6th Brigade moved into the Wide Bay area. The 6th Field Ambulance's "B" Company supplied the medical cover, and established a temporary A.D.S. south of Wunung plantation on 10th November with a surgeon, Major D. Henry, detached from the 2/8th A.G.H. Other medical units were not then available to take full care of patients; therefore the G.O.C. preferred that the A.D.S. at Jacquinot Bay should continue



(Australian War Memorial)

Ferrying supplies at Henry Reid Bay, New Britain.



(Australian War Memorial)

At Aitape General Blamey talks with a patient being treated for a fractured thigh.

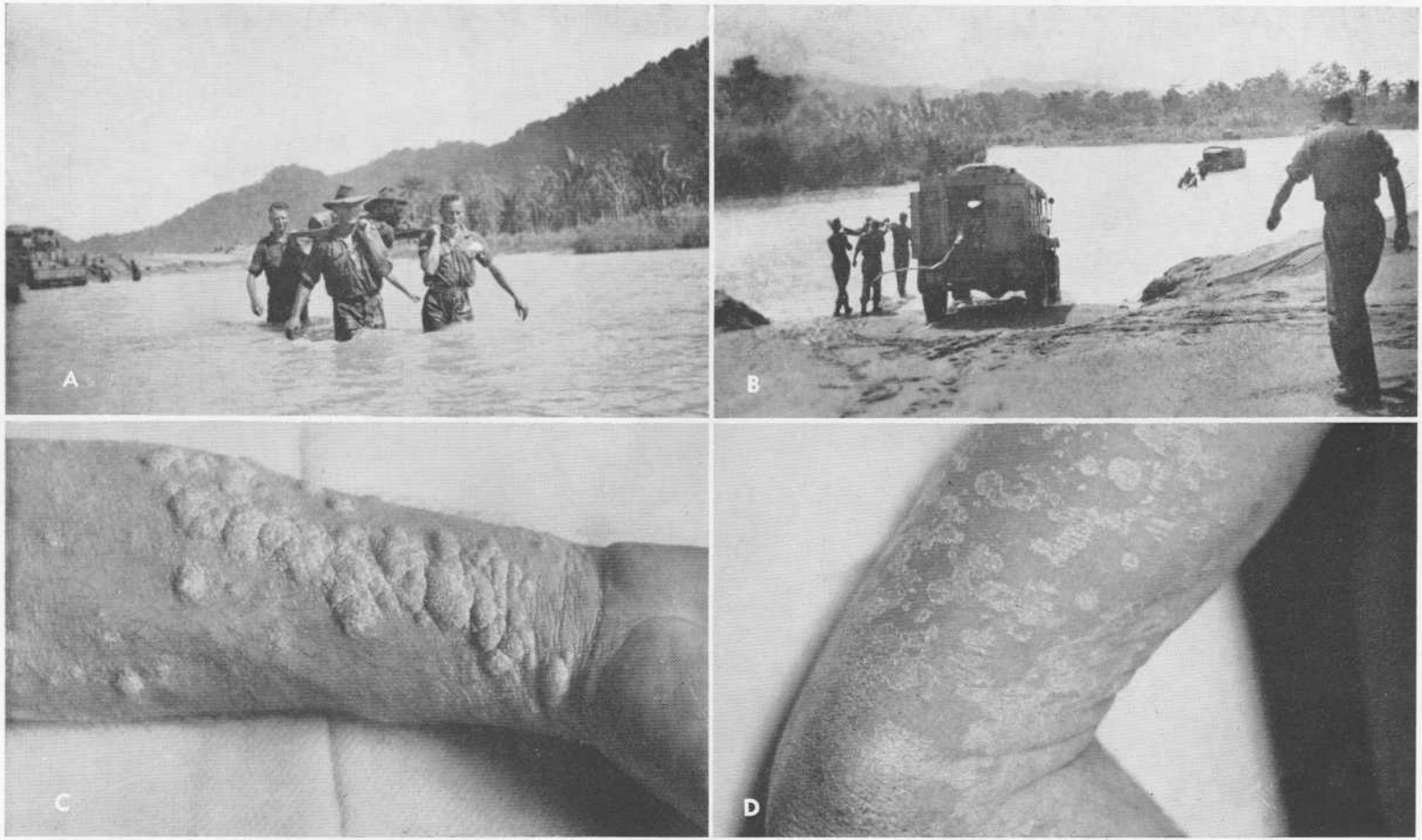


(A.A.N.S.)



(Lent by Lieut-Colonel J. S. Crakanthorp)

The 2/11th A.G.H., Aitape.



(A) and (B) Evacuation of casualties by the 2/7th Field Ambulance across the Danmap River. *(Lent by Lieut-Colonel C. H. Selby)*
(C) Lichenoid dermatosis due to atebrin. *(Major W. K. Myers)*
(D) Scaly type of dermatosis due to atebrin. *(Major W. K. Myers)*



(Major E. H. Hipsley)



(Major E. H. Hipsley)

The 3/14th Field Ambulance M.D.S. at Aitape.

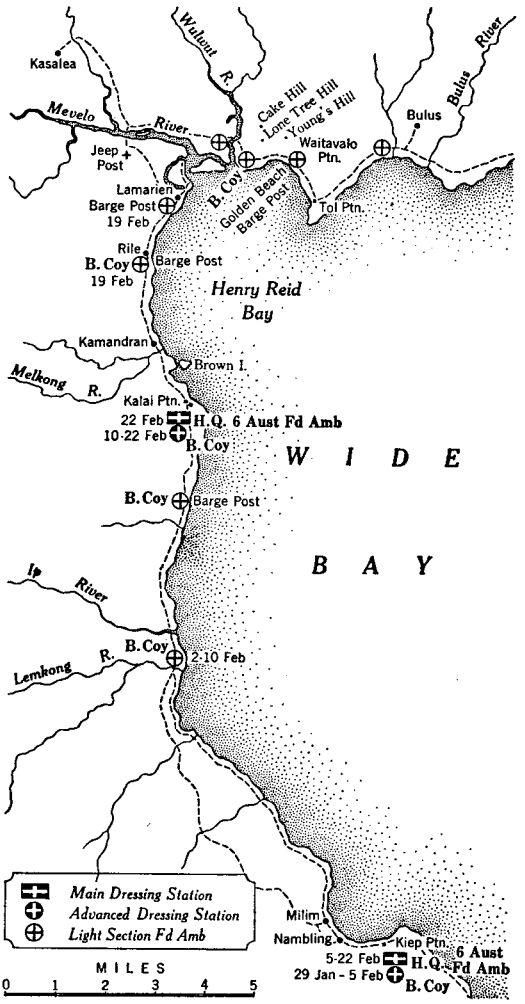
temporarily as the only medical holding unit available until the expected opening of the 105th C.C.S. early in January. This avoided the expedient of using other field ambulances as little hospitals, to which there were obvious objections. Patients were not held longer than necessary and were sent by air to Lae for admission to the 2/7th A.G.H. In May an air ambulance was available and patients were sent on direct to Lae using this service. The 2nd Field Ambulance, under command of Lieut-Colonel D. Zacharin, arrived in the Jacquinot Bay area at the end of November, and occupied a camp site in an abandoned coconut grove on Wunung River. During December a light section of "B" Company was attached to the 16th Battalion, which was on patrol duty. On 11th January "A" and "B" Companies moved to the Upper Wunung River and proceeded to construct A.D.Ss., while the headquarters prepared for the building of the M.D.S. up the Pula trail.

The 6th Field Ambulance set up an M.D.S. at Cutarp plantation on the south coast north of Jacquinot Bay on 16th December, and shortly afterwards the 105th C.C.S. arrived under command of Lieut-Colonel S. C. M. Hiatt, and began preparations for opening at Jacquinot Bay. The unit was ready to receive patients on 9th January, and a week later was holding 150 patients with fifty more beds equipped. It will be seen that once again the field ambulances were working in small detachments, and although much of the work fell on the 6th Field Ambulance, each unit was prepared to carry out varied tasks at short notice. The 2nd Ambulance took over a rest camp set up in its area by the 5th Division; within a month there were sixty men in the rest camp, and the M.D.S. held forty patients. The 107th Advanced Depot Medical Stores opened at the divisional base and began work.

In the middle of December the enemy were known to be in strength at Waitavalo, at the head of Henry Reid Bay, and later in the following month the 14th/32nd Battalion began an advance; companies moved by barge to Sampun and then patrolled the coast to the north. The battalion went on from Sampun to Milim in the Kiep plantation area and there set up a base. On 29th January "B" Company of the 6th Ambulance established an A.D.S. at Kiep near the Melkong River until an M.D.S. was ready to take over some days later. The headquarters of the ambulance then moved from Cutarp with the brigade.

Enemy patrols were operating south to the Ip River, and it was necessary to secure crossings over this river, so as to extend the operations of patrols farther north. Water transport was considerably restricted at this time. Jacquinot Bay was still in process of development as a base, and the demands on landing craft were greater than could be met. The only alternative was to slow the speed of the advance, and the 6th Brigade was instructed not to become deeply involved. The movements of the 14th/32nd Battalion therefore were carried out partly by water, with barges, and partly by road over a newly constructed jeep track. Progress was made, the battalion crossed the Ip River successfully and by 11th February proceeded to patrol as far north as the southern end of Kalai plantation.

The 14th/32nd Battalion was serviced by "B" Company of the 6th Field Ambulance, and at Kalai was relieved by the 19th Battalion, which began to advance up the coast. Arrangements were necessary for care of casualties of these two battalions; "B" Company, less a light section, set up an A.D.S. with an operating theatre at Kalai and prepared a site for an M.D.S.



Plans for the projected advance of the 19th Battalion involved considerable difficulty in evacuation of casualties. The move along the coast was simplified by a successful attack on the enemy positions west of Kamandran, which, reinforced by air and artillery assaults, culminated in the withdrawal of the Japanese. The 19th Battalion resumed its advance with a company of the New Guinea Infantry Battalion ahead, and by the end of February had mastery of the crossings over the Mevelo River, in place of a bridge which had, unfortunately, been washed away. The enemy had retired into his positions at Waitavalo plantation where he was harassed by additional guns.

A jeep track was extended to permit direct transport of casualties from the Wulwut to the Mevelo River, at the mouth of which a good position was found for barge embarkation, and by 4th March the light section of the 6th Field Ambulance moved to this point. The battalion R.A.P. was close to the battalion headquarters. At first, casualties were evacuated by hand carriage and later by barge across the ford to the aid post. The light section then moved across the estuary and settled close to the R.A.P., and after improvement in the track, jeeps took patients to the medical barge at the embarkation point of the river. Special jeeps with

stretcher frames were kept for emergency use on the road and were useful. On three successive days the barge came under mortar fire, and to avoid this unnecessary risk, evacuation was continued by road as far as Lamarien and thence by barge. The 4th Field Ambulance, which had arrived on 24th February at Jacquinot Bay, set up an M.D.S. in that area. This was on a favourable site with a plateau convenient for building. On 15th March a detachment was sent to Wide Bay to evacuate casualties from the 6th Field Ambulance back to the 105th C.C.S. at Jacquinot Bay. Members of the A.A.N.S. had arrived at the end of February and were attached to the C.C.S. The extremities of the Wide Bay-Open Bay line had now been reached by the divisional troops, and Headquarters First Army laid down the location of the line, which ran from the mouth of the Bulus River to Waitavalo plantation and thence to Lauli on the northern coastal sector.

ACTION AT WAITAVALO

It was now essential to capture Waitavalo, and preparations were made to complete this operation. The Japanese force was strongly entrenched along a spur that ran down to the river, and had his positions covered with machine-guns and mortars. The whole of this feature had natural protection in its steep approaches. Nevertheless the 19th Battalion advanced, and on 10th March was able to consolidate its position on Young's Hill. On the 15th the 14th/32nd Battalion relieved the 19th, and after two more days fighting the position was occupied. After the capture of Waitavalo a patrol from the N.G.I.B. crossed the peninsula, and, meeting the 36th Battalion near Open Bay, made contact with the force on the northern coast. The immediate objective of the Australian force was thereby gained; the northern and southern sectors were in touch, and a barrier was raised between the enemy's strong defensive position in Rabaul and the remainder of the island.

At the end of March the 2/8th A.G.H. opened in the 5th Base Sub-area under command of Lieut-Colonel C. R. Blomfield, using plane and barge transport for sick and wounded.

Evacuation

Forward evacuation times tended to increase during the action. The R.A.P. was not so forward in location, and for safety reasons had to remain on the far bank of the river until the high ground overlooking the river crossing was taken. When two features known as Cake Hill and Lone Tree Hill were captured, the aid post was moved to the foot of Lone Tree Hill, but the light section of the ambulance remained in its previous place. The steepness of the hill greatly increased difficulties of transport, but canvas tops of stretchers were used with great success. When the aid post was moved to higher ground the access was much easier. A further trouble arose with the tides and rising of streams after rain. Sometimes barges could not approach nearer than thirty yards, and stretcher bearers often had to wade into the water to their waists. Some

of the barges were not satisfactory, being difficult to manoeuvre except when the embarkation points were unusually conveniently placed. On 19th March the medical barge calling at Waitavalo broached in the swell and despite all efforts to tow off the vessel it became a total wreck. It was then necessary to use barges allotted to the brigades for operational purposes; thanks to the cooperation of the brigade command, a satisfactory compromise was achieved. Great help was also given by members of the 2nd Field Ambulance along difficult parts of the track; natives were seldom available and field ambulance members and infantrymen did most of the carrying.

This final action was completed on 20th March. Headquarters of the 14th/32nd Battalion then moved into Waitavalo and set up in the area Golden Beach where the 6th Ambulance had a beach evacuation point. The 19th Battalion came to occupy the Moondi River line and ensured that no infiltration of enemy would occur. Evacuation of casualties there was by hand carriage to the Bulus River ford, and thence by jeep to the barge point.

The headquarters of the 6th Brigade moved into Tol plantation, but the field ambulance M.D.S. remained at Kalai, and arrangements for disposal of sick and wounded were the same. For transport of patients to the C.C.S. in South Wunung area a 40-foot ambulance work boat fitted with stretcher frames was found most useful: this type of craft was found more satisfactory than a medical launch, but it was felt that a faster 60-foot boat would have been preferable. During March the C.C.S. held up to 290 patients but surgical cases were not transferred to 2/8th A.G.H. till April, as the hospital was not then working in that area. Surgery was done by Major J. R. Magarey at the C.C.S.

THE CLOSING PHASE

The defeat of the Japanese on the south coast practically ended the fighting. South of the Sai River occasional clashes occurred between patrols, but the enemy, as previously, withdrew after counter-attacks. During April heavy rain flooded the river and its swampy approaches, confining the patrol area to the southern side. From this time onwards patrol activities continued in the region of Wide Bay and Open Bay, and the enemy was successfully contained within the line across the peninsula after the decisive conclusion of the action at Waitavalo plantation. A feature of the operations was the modest extent of the forces employed. This was in evidence in the medical services also, for, although there were ample resources both in base areas and in the field, the problems raised by the familiar technique of splitting the medical field force were accentuated by the almost complete separation of its two chief components. Evacuation of sick and wounded was aptly handled, and wisdom was shown in the avoidance of road transport in an uncompromising terrain, where water and air offered more speed and comfort than land travel. Preventive medicine too had its rewards, in spite of the preponderance of illness over battle injuries.

On 6th April arrangements were made for the 2nd Ambulance to relieve the 6th. Accordingly the main body of the unit moved to Tol, arriving on the 15th, and a surgical team in charge of Major J. L. D. Scott was attached from the 105th C.C.S. This help was needed, as the 16th Battalion had been ambushed at Jammer Bay, and eleven casualties required treatment. A change in command of the 6th Field Ambulance was made during March, Lieut-Colonel A. D. Frost taking over on the 12th. The 6th Brigade was relieved on 12th April by the 13th Brigade under command of Brigadier E. G. H. McKenzie and on 19th May the 36th Battalion was relieved on the north coast by the 37th/52nd Battalion.

While the action at Waitavalo was taking place there was little activity in the north; on 13th April a trial flight was made by a Walrus aircraft with the object of establishing an evacuation air route for urgent cases to Jacquinot Bay. Routine evacuation was still made from Hoskins to Lae. Conferences took place between the A.D.M.S. Colonel Saxby and the D.A.D.H. of the 5th Division Major P. S. Woodruff, and the commanding officers of 6th Brigade and the 6th Field Ambulance concerning the medical arrangements. These were satisfactory except for the time factor in bringing in casualties, as the difficult country caused frequent delays in transporting wounded to the R.A.P. The Consulting Surgeon, Colonel Littlejohn, and Colonel A. W. Morrow, Consulting Physician, attached to Advanced Land Headquarters, visited the Jacquinot Bay area in June. Such visits were of the greatest help to medical units, especially in more or less isolated places, and opportunity was taken during such visits for some tutorial work in general medicine and surgery. In this instance the consultants saw all patients in the M.D.S. with the medical officers in charge, and, although the period of action was nearly over in Waitavalo and Tol areas, the light sections forward were visited while actually at work. The D.M.S. First Army, Brigadier Maitland, also visited the 2nd and 4th Field Ambulances.

MEDICAL CONDITIONS

Battle Casualties. The figures for battle casualties for the period October 1944 to July 1945, were 5 officers and 43 other ranks killed and 13 officers and 122 other ranks wounded. Five hundred and thirty-one were evacuated sick, and of these nearly half were considered due to preventible disease.

Malaria. The incidence rate was low throughout. Total malarial casualties for the period 11th October-21st March were forty-one, an average rate of 0.85 per 1,000 per week for the brigade group. It was noticed that the highest rates were those found in units engaged in active operations. In the latter part of March, for example, the 5th Division had a rate of 0.63 per 1,000 per week, 4th Brigade 0.83, and 6th Brigade 1.73.

Even these rates were very low compared with those experienced in other formations committed to greater operational activity, and more exposed to the natural hardships of the country. In general the A.D.M.S. considered the low rate to be due to a very high standard of malarial

discipline regarding the use of atebrin, repellent lotion and correct dress. Malaria control unit detachments used D.D.T. in forward areas, and also aerosol dispensers, one per infantry section, to kill adult mosquitoes in newly occupied areas. Nevertheless Woodruff, after inspecting the 6th Brigade area observed active breeding of anophelines.

Aedes scutellaris was observed in large numbers in some areas on New Britain as in other islands, but dengue fever was almost absent, though the presence of many adult mosquitoes of any type was a good reason for vigorous action.

A study of the malaria incidence rates per thousand per week from November 1944 to March 1945 showed two peaks; one in November with a figure of 1.4, and one in March with 1.2. This illustrates that even in a well-controlled force the press of action or other strain tends to reflect on the standard of malaria prevention. It must be remembered that there are obvious fallacies in comparing results in different areas with different external conditions and military responsibility. In New Britain the troops were seldom extended and the periods of fatiguing action were not prolonged.

Dysentery. An outbreak of dysentery had taken place in the 19th and 14th/32nd Battalions and this was investigated. After full discussion with the consulting physician and medical officers concerned, the men of both battalions were given 4 grammes of sulphaguanidine daily for five days. The result was very satisfactory, as the outbreak quickly settled down. The rate of 2.8 per 1,000 in the middle of March was due to a localised flare of epidemic type and brief mass therapy quickly abolished it.

Typhus. A few cases only were reported, and no special outbreak of focal importance occurred.

Skin affections. The 5th Division, like other formations under similar tropical conditions had a high incidence of skin disease. The three months of most active work coincided with the highest rates, the peak being 4.3 per 1,000 per week.

Hookworm. The prevalence of ankylostomiasis was noticed in New Britain as in other similar areas. The incidence among natives was known to be high, and a survey was carried out at the instance of the A.D.M.S. At the end of June a report was compiled showing the incidence of hookworm ova among the troops. Ova were found in the excreta of 78 of 692 soldiers, who represented units of all kinds. The numbers found infected with other intestinal worms were negligible. It was interesting that 165 men showed eosinophilia: 81 showed 6 to 10 per cent, 29 showed 11 to 15 per cent, 20 showed 16 to 20 per cent, and 16 had 21 to 30 per cent. It was evident that the degree and amount of infection with hookworm was considerable: 119 men had eosinophilia though no hookworm ova were seen. The highest rates were found in two infantry battalions whose members had served for two years in the islands, including a period of active operations. The most heavily infected battery of the 2/14th Field Regiment had also served months longer than other components of the regiment. There were thus a direct relation to length

of exposure. The infections were almost invariably mild, as judged by the concentration of ova.

Surgical work. Surgical teams were detached from several of the holding units, including the 2/7th A.G.H. at Lae. The constitution of such teams was that found practical in recent campaigns, a surgeon in charge, another medical officer and several other ranks with relevant experience. Arrangements were made for adequate resuscitation and necessary front-line surgery; patients could be held in an appropriate A.D.S. or transferred to an M.D.S. or the C.C.S. in the southern area, or could be flown direct to Lae. The work done and the local conditions prevailing followed the usual patterns. At Kalai the casualties arrived from about 4 p.m. onwards and through the night. The more severely wounded were kept for several days till well enough to be sent to the 2/8th A.G.H. at Jacquinot Bay. Evacuation was usually by American barges, after delivering troops and supplies.

END OF HOSTILITIES

When Japan capitulated on 15th August, the 4th Brigade and the 4th Field Ambulance were advised by the 11th Division that they would make an initial landing at Rabaul. After dismantling the unit and transferring patients to the 2/8th A.G.H. the ambulance personnel entered Simpson Harbour in the *Manoora* on 10th September. Wards and other departments were erected with all speed and medical staff worked hard to examine and attend to prisoners of war. Many of these had chronic malaria and malnutrition, and marks of ill-treatment. Nearly 250 Indian prisoners arrived, and nurses were flown to Rabaul to care for females, chiefly nuns, among the prisoners. By 19th October 855 prisoners of war had been admitted to hospital. A theatre was built and necessary emergency surgery performed; early in November the unit was dismantled and transferred to a new site.

The 105th C.C.S. was also sent to Rabaul, with other medical units from formations in New Guinea. Some of the prisoners of war were sent from Rabaul to Jacquinot Bay and admitted to the 2/8th A.G.H. On 14th September the 105th C.C.S. arrived at Rabaul, and after setting the Japanese to work to clean up the filthy conditions in their compounds, the staff began to prepare their own unit site and erect tents. All necessary precautions were taken to prevent appearance and spread of infectious disease; a feature of the methods used was the spraying of the area with D.D.T.

The ending of hostilities was foreshadowed by several moves and changes in commands. The Headquarters of the 11th Division had relieved the Headquarters of the 5th Division on 26th July, and in the following months hostilities ceased and the war was over. The collapse of Japanese power in the S.W.P.A. evoked specially poignant memories of the events of March 1942, when the remnants of a slender Australian defence force attempted and, with some degree of success, carried out a hazardous withdrawal against hopeless odds. It was with no little satisfaction that the Australians now entered Rabaul.

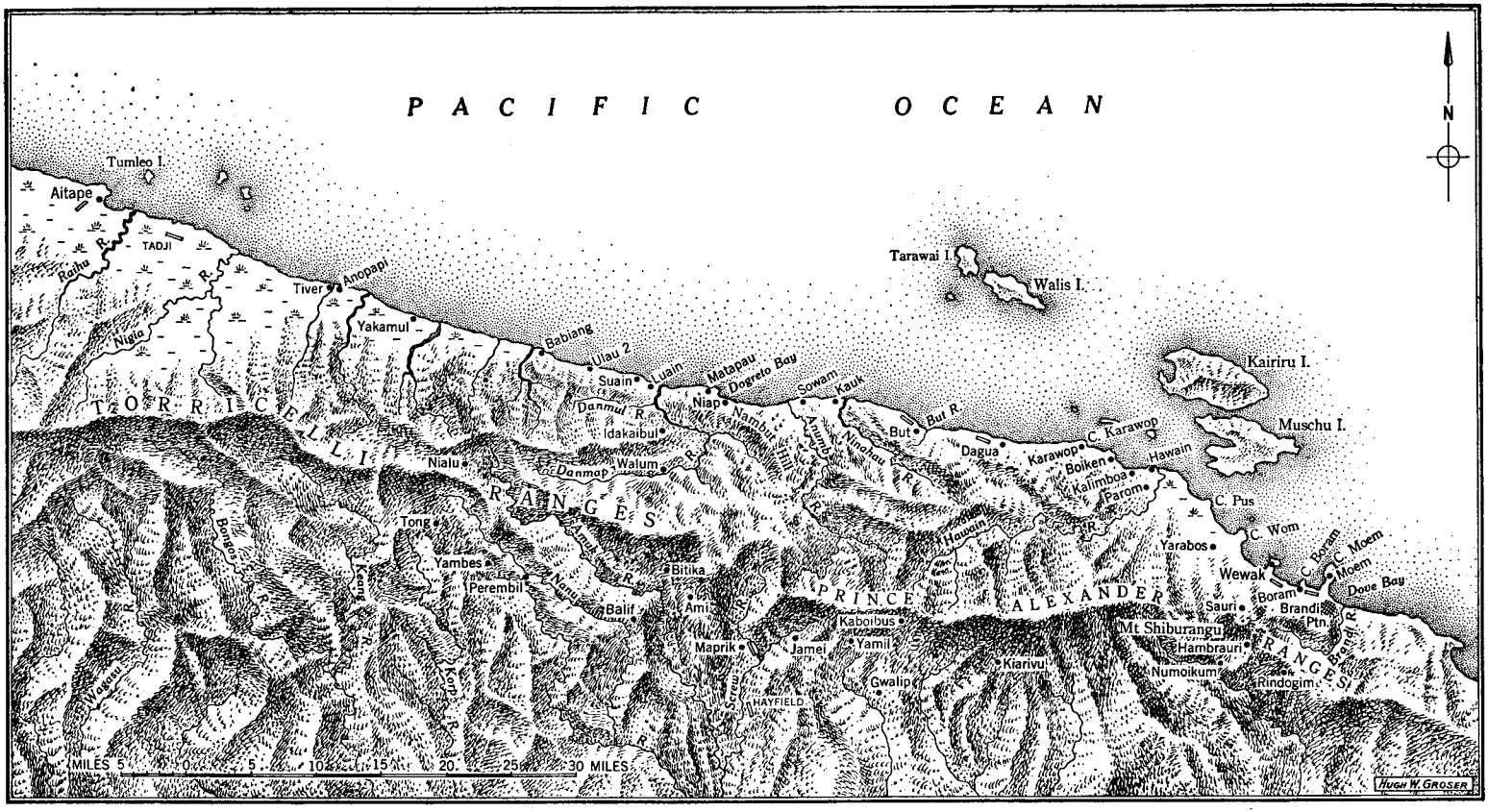
CHAPTER 15

AITAPE-WEWAK

THE previous campaigns of the Australian divisions in New Guinea ended in the clearing of the Japanese from the Huon Peninsula and the inland valleys of the Markham and Ramu Rivers, and the concentration of the 5th Division in the Madang-Alexishafen area. Further exploration along the coast past Hansa Bay failed to disclose any Japanese, and reconnaissance from the air showed that the widespread swamps at the mouth of the large Sepik River imposed a formidable obstacle to the movement of large forces south from Wewak. Consequently the enemy could be by-passed beyond this area, as was proved when in April 1944 the Americans made simultaneous landings at Aitape and at the Japanese air base at Hollandia.

At Aitape the immediate object was to hold the airfield and to secure a light naval base. The American troops established a strong defensive position, and after being reinforced to meet an expected strong attack, finally pushed the enemy back during August. By the middle of September the Australian force had established a base at Bogia, and had withdrawn the balance of troops to Madang. Arrangements were made for the Australian 6th Division to take over the Aitape area, and the necessary movement and exchange began in October. Since the determined but ultimately unsuccessful assaults of the Japanese in July, the American force had limited its land operations to defensive measures, and latterly to patrolling. The Japanese remaining in the area from Aitape to the Sepik River were chiefly in the coastal area between the Danmap and Sepik Rivers, and south of the divide in the Maprik and Sepik Valley areas. Their strength was estimated at some 24,000 troops, but there was reason to believe that disease and malnutrition had reduced their military potential. At the time when the Australians took over practically no contact was being made with the enemy.

The country over which the 6th Division was to assume a role far from passive, or even purely defensive, was distinguished by two chief features, a high coastal dividing range and a constant succession of coastal rivers intersecting the flattening plain which stretched from the divide to the sea. This divide ran within a short distance from the coast, ranging from a few miles near Wewak to twelve miles closer to Aitape. Two mountain ranges formed the watershed, the steep and rugged Torricelli Range, with ridges of nearly 5,000 feet in height, and steep gorges, all heavily wooded, and the less precipitous Prince Alexander Range. On the south, these fell sharply into the valley of the Sepik River, and fed the countless coastal streams on the north coast. These streams imposed a serious obstacle to advance, and after heavy rain flooded readily, becoming wide, deep and dangerous in places, and often changing their course. The rainfall on this section of the New Guinea coast varied from



Aitape-Wewak.

90 to 100 inches a year. Heavy rain south of the divide flooded the extensive swamp systems of the Sepik River, which could only be crossed on foot at a few places.

The most important settlements were Aitape and Wewak, both of which had good anchorages, especially the more sheltered Wewak, and satisfactory sites for airfields. Only a few miles of road existed in the coastal area near Aitape and Wewak, and between Maprik and Marui inland; other land communications were restricted to primitive native tracks. Most of the native population lived in villages inland from the coastal divide, where there were considerable natural resources of food in cultivations established on the rising ground south of the Torricelli Range. The coastal plains were similar to many others on this coast of New Guinea, narrow and flat, with occasional low spurs running down to the foot tracks. Inland the native settlements and gardens stood in clearings, usually on high ground, which gave them some tactical importance, but otherwise these areas were covered with dense forest. Most of the coastal flats were covered with kunai grass, and the neglected coconut plantations were generally thick with undergrowth. Mangroves grew densely and freely in the swamps. All water supplies had to be carried by hand.

AUSTRALIAN BASE AT AITAPE

An advance party arrived at Aitape on 15th September 1944, and chose sites for the various installations on a narrow strip of land between Aitape and the Raihu River. There was only one road in the area, running one and a half miles from the Raihu River along the coast. A month later some base troops arrived with supplies, and during October the 3rd Base Sub-area was sufficiently stabilised to provide for the Australian troops there. The Headquarters of First Australian Army instructed the 2/6th Cavalry (Commando) Regiment, subject to the 43rd United States Division, to begin the relief of the American outposts and patrol the tracks leading to the Torricelli Mountains, and part of the coastal area. These patrols were very active, and emerged from a number of sharp clashes with the enemy without loss.

During this early period the 43rd Division retained command of the area, with an agreement that tactical control of the troops rested with the Australian divisional command. The headquarters of the 6th Division, commanded by Major-General J. E. S. Stevens, moved in during October, and opened at Aitape on 8th November. On the 12th the 3/14th Field Ambulance, under command of Lieut-Colonel R. F. K. West, arrived in the *Katoomba*; its immediate role was to open an M.D.S. of fifty beds, to take over several R.A.Ps. in the base area, and to establish a beach medical post. The 104th C.C.S., commanded by Lieut-Colonel K. C. T. Rawle, travelled by the same ship, and landed on 13th November with its eight nurses. The 19th Brigade, under command of Brigadier J. E. G. Martin, arrived from 1st to 19th November with an armoured squadron, and artillery. Their medical care was provided at first by the 118th United States Medical Battalion, and the 30th United States

Evacuation Hospital, until the Australian units were established. On the 26th the 2/7th Field Ambulance disembarked. During December the 17th Brigade under Brigadier M. J. Moten and the 16th under Brigadier R. King arrived. The command passed to the 6th Division on 26th November, though it was the beginning of January before the division was at full strength. The medical holding units, under command of the 3rd Base Sub-area at Aitape, had arrived early; the 2/11th General Hospital and the 104th C.C.S. were in the area by the third week in November. The C.C.S. was able to take patients by 30th November and on 3rd December to receive Australian battle casualties hitherto admitted to the 30th United States Evacuation Hospital. The remaining field medical units arrived a little later, the 2/2nd Field Ambulance on 11th December and the 2/1st Field Ambulance on 3rd January. The 8th Malaria Control Unit, one of three allotted to the division, early began its work in the neighbourhood of the base area. At first the operational activity of the force was restricted to the objective of destroying the enemy forces west of the Danmap River, employing squadrons of the 2/6th Commando Regiment, which went forward of Babiang, towards the river.

At the end of November, the 2/7th Field Ambulance, commanded by Lieut-Colonel C. H. Selby, sent a detachment to Babiang at the mouth of one of the numerous coastal rivers. First clashes with the enemy forward of Babiang produced a few casualties; these were sent back by road, at first to the American hospital, but on 1st December the 2/7th Ambulance opened an A.D.S. at Tiver, and a light section at Babiang. The M.D.S. was established in the Aitape area, on a pleasant site on the Nigia River facing the sea. On a visit to Babiang through heavy rain Selby and his quartermaster found the rivers a foot over the bridges, and were forced to leave their bogged jeep and walk home. These conditions were features of the coastal area, though transport was simplified by the energy of the engineers, who built thirty-five bridges in a few weeks. A dressing station was established at Nusite with a theatre and a 40-bed ward; here a surgical team was set up and, with necessary additions, the A.D.S. became the headquarters and M.D.S. An intermediate car post was established at Yakamul.

Already the difficulties of evacuation of casualties in this coastal terrain were apparent. The road trip back to the M.D.S. took only two hours at low tide, but up to seventeen hours at high tide. Between Babiang and the Nigia River on the way back to Aitape there were fifty river crossings. The danger of flooding of the coastal rivers was soon realised too. Some of the surfing beaches were dangerous, especially at the mouths of flooded streams; on 4th December three men were carried out to sea during an organised surfing parade, and in spite of full life-saving facilities one was drowned.

A more active and important question had arisen during the month, that of endemic illness. In Aitape, in the 3rd Base Sub-area the 3/14th Field Ambulance had to expand to 172 beds, and on 22nd December held 128 patients, who had to suffer the inconvenience of leaky tents.

The 104th C.C.S. on 16th December had 300 beds equipped and 250 occupied. In this unit the heavy rain caused difficulties of drainage, but a more unhappy state of affairs had arisen in connection with the evacuation of mental patients. Rawle was most dissatisfied with the existing organisation, though arrangements had already been made for several ill patients to be flown to Lae. He insisted on being paraded to General Stevens, and the divisional commander initiated enquiries which helped greatly to rectify administrative defects and heighten the priority of these urgent cases.

THREAT OF MALARIA[1]

Of greater menace was the threat of an epidemic of overt malaria. Early in December this was recognised, and with lively memories of similar difficulties in the Huon-Ramu campaigns, prompt measures were taken to insist on firm discipline and adherence to the set procedures of prevention. All febrile illness was taken seriously, and the significance of dengue fever was perceived, for its appearance in the area, though in no way related to malaria, indicated that the campaign against adult mosquitoes was failing in performance. Stevens called a conference, at which the subject was thoroughly discussed, and three boards of investigation were appointed, each including a medical officer and a combatant officer. The number of cases was not serious of itself, though at the end of the first week in December the C.C.S. held 180 patients, nearly all suffering from endemic illness, and the 3/14th Field Ambulance held thirty. The whole question was given close attention by the Commander-in-Chief, who enquired into the position on the spot: he and the divisional commander and his advisers recognised the great importance of remedying at once, if possible, any weaknesses in malaria prevention. Colonel H. M. Fisher, the A.D.M.S., in his war diary used stronger expressions, stating that "cases of malaria within the division were coming in at an alarming rate".

On 9th December the A.D.M.S. noted that the wastage rate for the division for the preceding week was 1.3 per 1,000 per day: more significant was the current disturbing rate of proven malaria within the division. On the 15th, the rate had risen to 1.9 per 1,000 per day. The 8th Malaria Control Unit was in the area and local control was proceeding. There were, however, some weak points. A month earlier the A.D.M.S. had pointed out that facilities for the diagnosis of malaria were not sufficient. By the beginning of January the strength of army and air force formations and units was expected to reach 23,000, but there was only one laboratory with one trained pathologist at the 2/11th A.G.H. The commander had ordered that every case of malaria was to be strictly investigated, and if necessary disciplinary action taken. This made accurate diagnosis all the more important.

[1] The malarial epidemic among troops in the Aitape-Wewak area has been dealt with in detail in Volume I of this series, *Clinical Problems of War* in Chapter 7, pp. 133-145. The scientific and epidemiological aspects are described in this section, but are abbreviated in the present chapter, which deals with the epidemic as it affected operations, the work of medical units and administration.

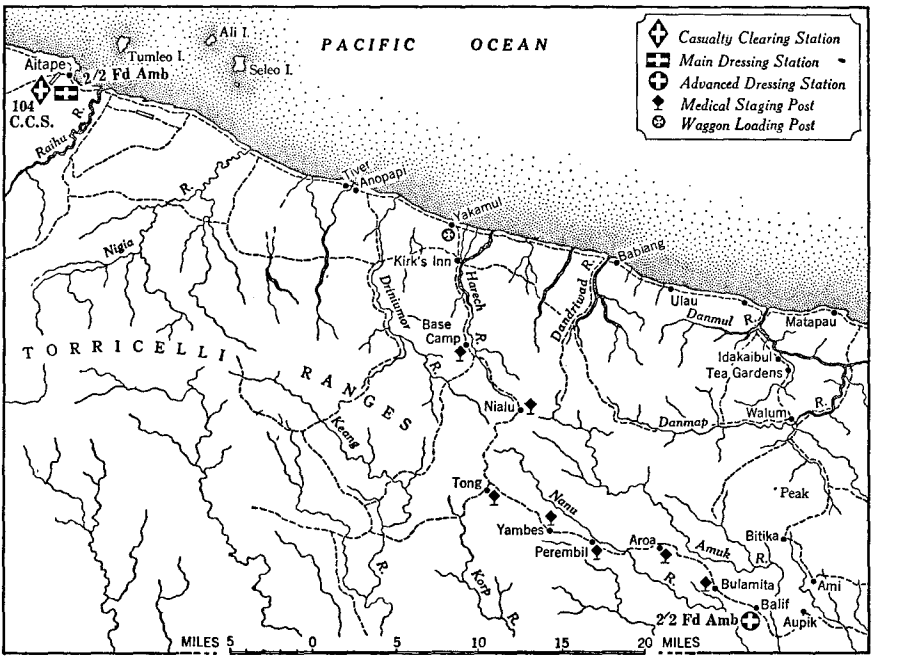
Major G. Read, D.A.D.H. 6th Division, made a special investigation. This did not show any unusual features in the mosquito types or in transmission, and a reasonable infectivity rate, not greater than 1 per cent in dissected mosquitoes. Organised control of the adult and larval mosquitoes was satisfactory in the area so far treated, Aitape-Nigia, but the whole coastal strip from Aitape to Wewak was without doubt highly malarious. Ground control of adult and larval mosquitoes was carried out by the 2/4th and 8th Malaria Control Units under command of Captains L. C. Milliner and J. E. C. Aberdeen, who was later transferred to command an entomological section and was relieved by Captain F. W. Berrill. Lieut-Colonel J. C. English, malariologist to First Australian Army, initiated some trials of aerial spraying with D.D.T.; these were fully successful and the possibility of further regular use of this method was examined.

Once the force was established at Wewak air spraying with 5 per cent solution of D.D.T. in oil was put on a regular basis along the coast, and carried out by an R.A.A.F. air crew in a specially equipped Beaufort made available to the division. It was believed that this made a material contribution, but, despite all efforts to maintain air and ground control, the mosquito population, though reduced, was always dense: Read found this was consistently high by comparison with other areas. Though the sporozoite rate was not high, 1 per cent, this was offset by the numbers of adult mosquitoes. Since investigation disclosed some defections of malarial discipline in two units of the 19th Brigade, and so that the trouble would not spread to other units or formations, the G.O.C. ordered troops east of the Nigia River to be given two tablets of atebrin daily from 13th December. This was continued until 29th December, when the daily dose reverted to 0.1 gramme, that is, one tablet. Read advised that this increase be maintained until the current rates of incidence in the brigade subsided.

MEDICAL PROBLEMS OF WEATHER AND DISEASE

The 2/2nd Ambulance under Lieut-Colonel Smibert, arrived at Aitape and on 26th December sent a detachment inland under Major P. J. Parsons to set up an A.D.S. at Tong, with a staging post at Nialu and an A.D.S. at Anopapi on the coast, with other staging posts at appropriate intervals along the evacuation route. This was by jeep to Anopapi and onwards to the 104th C.C.S., and, after the capture of Walum by the 2/7th Commando Squadron, with an alternative route through Walum and Idakaibul to the 2/4th Battalion R.A.P. east of the Danmap River. The A.D.M.S. arranged at this time that all evacuations should proceed through the C.C.S., whose commander could select patients for transfer to the general hospital. The 2/2nd Ambulance thus serviced the 17th Brigade, whose assignment was the inland sector, and in the present instance was in support of the 2/5th Battalion. The A.D.S. moved with the battalion, leaving behind enough men to serve a medical staging post. This was necessary, as evacuation either had to be made on foot or by

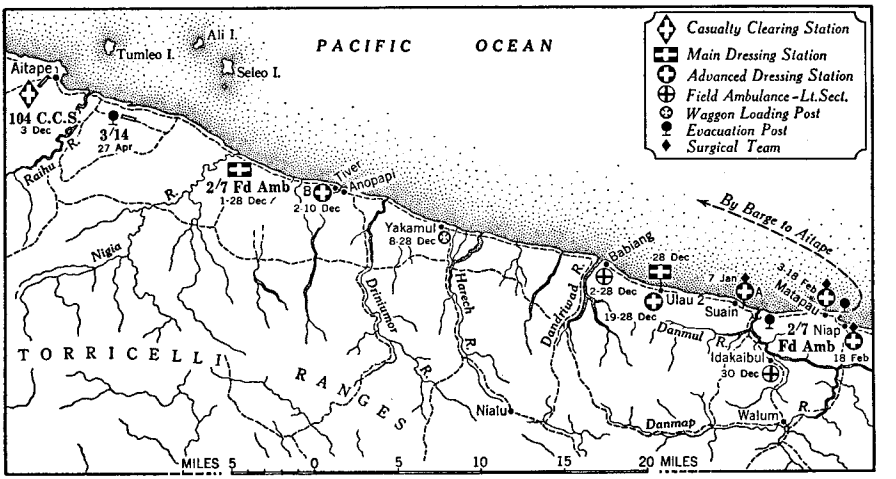
native bearer teams. The routines were now so well established in these experienced units that a building team sent on ahead to a new site, could do the necessary construction in two days, and the A.D.S. could be set up within an hour of the arrival of the staff. With these moves began the second phase of the operations in the inland sector.



On 1st January the 2/11th A.G.H. began work under command of Colonel J. S. Crakanthorp: the next day Lieut-Colonel D. A. Cameron arrived with his unit, the 2/1st Field Ambulance. This unit was to relieve the 2/7th Ambulance at Aitape when the 16th Brigade relieved the 19th on the coastal sector, but these plans were set back by flooding caused by torrential rain. Towards the end of the month heavy rain again caused great inconvenience and hindrance. Wards in the C.C.S. were flooded, necessitating special arrangements for drainage. The A.G.H. suffered likewise, and it soon appeared that drainage of the site was a major problem. Some tented wards leaked, others had water under foot, as the nurses had in their quarters. A bridge over the Raihu River was carried away, temporarily holding up evacuation of patients. Selby arranged for a jeep ambulance to be towed to a point where it could ply from the river under its own power, and a squad of bearers was posted to carry patients across the Danmap River. New rivers appeared in two places between the M.D.S. and the Danmap, but a jeep ambulance was stationed on each side, and a special squad was employed to carry patients

across the stream. If the current became too fast, arrangements were made to instal a flying fox. In this way wounded could be brought to a surgeon in six to eight hours. There was now an A.D.S. at Suain and a surgical team was working there.

By the 17th the continual rain had washed away the bridge between Aitape and the M.D.S., blocking the road for motor ambulances, but access was gained by towing the ambulances to the M.D.S. until the bridge was made practicable for jeeps. The next day traffic to the C.C.S. was barred



by a damaged bridge, and two wards of thirty beds were erected, one at the A.D.S. and one at the M.D.S. at Ulau. On the 19th more difficulties appeared. The flying fox over the Danmap broke down, and a landslide blocked the road and cut off a jeep. Hand transport was possible over this awful track, and across the river, and wounded men were still within seven hours' reach of the surgical team at the A.D.S. On the 22nd, bridges were washed away on the line of evacuation of the A.D.S. of the 2/2nd Field Ambulance within twenty miles of Aitape. Stretcher bearers carried two loads of sick from the 2/7th Ambulance across the rivers, and trucks and jeeps completed the journey to the C.C.S. By nightfall all were safely housed in the A.D.S., and the bridges were repaired. Next day the sick completed the journey in safety. Further heavy storms increased the flooding of the coastal streams, which became raging torrents near the sea. In these series of coastal floods three men were drowned and nine were missing. An emergency sick bay was set up by Captain A. F. McSweeney at the Danmap River, in case crossing became impossible, and arrangements were made for any urgent surgery to be carried out at the 2/3rd Field Regiment R.A.P. On the 30th the 2/2nd Field Regiment provided space for a sick bay for six men with a surgical team, under protection of the 2/8th Battalion. At the 2/7th Ambulance M.D.S. at

Ulau the surgical work was proceeding smoothly under the direction of Major J. J. Ryan. This dressing station grew to a capacity of 300 beds during this month owing to difficulties of evacuation, and in addition had to establish a small hospital of thirty beds at Suain to cope with an outbreak of cerebro-spinal meningitis among the natives.

MALARIA CAUSES ANXIETY

Back at the base area at Aitape conditions were superficially tranquil, but the 2/4th Battalion had returned with many sick: fifty patients a day were entering the M.D.S., half of them with malaria. These were transferred to the C.C.S. During the third week in January malaria was rising in incidence in the 19th Brigade, and on 29th January the divisional commander ordered the dose of suppressive atebrin to be increased to two tablets a day for the whole of the division. Smibert, by request of Martin, made a report on malaria in the 2/7th Battalion at this time, and concluded that the figures for malaria then compared not unfavourably with those in other formations in New Guinea. He drew attention to the importance of securing and using in the correct manner, supplies of mosquito spray as soon as a unit arrived in an infected area. The report emphasised the necessity for much more thorough application of mosquito repellent, detailed instructions in the use of mosquito sprays, attention to the siting of unit lines in relation to native compounds, and the desirability of pointing out to troops that the measures laid down were, when properly carried out, having a telling effect in combating malaria. Blamey directed that a conference be held at divisional headquarters at the end of January to discuss the whole position.

The anti-malarial routine procedures were already laid down and were being well followed on the whole, but additional measures were taken to ensure strict adherence to these by all ranks. It was certainly curious that the 19th Brigade on its relief by the 16th Brigade early in the campaign, though freed from the initial pressure under which they had been working, showed at first not a fall, but a substantial rise in malaria. Stevens in addressing the members of the conference on 31st January said:

> We have investigated 150 cases of malaria. In each case there has been evidence that atebrin has been taken, except in one instance. . . . From these investigations we have found precisely nothing, except a certain amount of carelessness on the part of some officers in not attending to several minute details of the orders.

After traversing certain disciplinary actions taken in units with poor figures, he remarked that improvements had followed such actions in several units, but "disciplinary action is the wrong way to get results". He further stressed the importance of a more vigorous campaign against the adult mosquito, and the more faithful use of repellent lotion, and urged that general attendance at atebrin parades in every unit, except those in actual contact with the enemy, should be an obligation. To this should be added the comment that the performance of the division rested on a long history of achievement and high tradition, which could hardly



(Australian War Memorial)

Wards of the 104th C.C.S., Cape Wom.



(Australian War Memorial)

Sisters coming on duty at the 104th C.C.S., Cape Wom.



(R.A.A.F.)

An Auster air ambulance arrives at Aitape with a wounded soldier from the Torricelli Mountains.



(Major E. H. Hipsley)

Aitape beachhead and the 2/11th A.G.H.



(Australian War Memorial)

Blood transfusion being administered to a wounded soldier within 100 yards from the enemy in the Aitape sector.



Transferring a casualty from the Auster to road ambulance for transport to hospital at Aitape. *(R.A.A.F.)*

fail to be impressed on reinforcements. The exact drill laid down for atebrin administration was as follows:

(a) Men will parade carrying a container, other than a water-bottle, filled with water.

(b) The daily atebrin parade will always be held by an officer.

(c) The officer will follow and never vary from the following procedure:—

(i) He will place the atebrin tablets one at a time into each man's mouth, either by hand or by some utensil.

(ii) Each man will take a mouth full of water and swallow it with the first atebrin tablet. The procedure will be repeated with the second tablet, but this time the man will drink the full remaining contents of his water container, and will turn the container upside down.

(iii) He will then call his name.

(iv) This man will then open his mouth so that the inspecting officer can ensure that the tablets have been swallowed and are not in the mouth.

(d) A roll book, not loose sheets of papers, will be kept in which the officer will record the taking of the daily dosage. This book, which must be signed by the officer, must be available for a period of two months following any entry.

Smibert expressed what he believed was representative of the view of the medical commanders of the division, that the lack of trust thus implied in the men would have a bad effect on morale, especially as the official instruction stated clearly that one tablet of atebrin taken daily was enough to suppress all forms of malaria. These objections were not technical, but based on views of discipline and administration, and were voiced also by Lieut-Colonel Cameron of the 2/1st Ambulance, Lieut-Colonel P. K. Parbury of the 2/7th Battalion, and Major J. R. Nosworthy, the divisional legal officer. Stevens replied that unfortunately he did not agree with this view, and that no further action could be taken other than the obeying of the order. Smibert placed his objections in writing in the unit war diary for record, but of course the order was implicitly obeyed by all responsible officers. He considered that the important question to solve was not the degree of adequacy of the official atebrin dosage or whether this was being taken by the men, but whether the handling of the situation was the best in the circumstances.

In spite of the first period of increased atebrin dosage, the malarial rate reached 44.8 per 1,000 per week in the 19th Brigade. This peak was attained during the week ending 2nd February, when the brigade was virtually in reserve. Examination of 388 men with fever in the 2/7th Field Ambulance from 1st December to 19th January, showed that 94 (24 per cent) had demonstrable parasites in their blood. After the dose of atebrin had been increased to two tablets a day the percentage dropped to 9, but during two periods when only one tablet was given it rose to over 35.

There was good reason for securing a higher concentration of atebrin in the blood plasma of men of the 16th and 19th Brigades in view of the important commitments of these formations. It was hoped that this would

ensure that the atebrin in the blood would not fall below the concentration shown by the Cairns experiments to be sufficient to suppress overt malaria.

The 17th Brigade and the 3rd Base Sub-area were included in this order, but this brigade was placed differently from the 16th and 19th, for its initial malarial incidence rate for its battalions singly or together did not exceed 5 per 1,000 per week until 26th January, when it began to rise in one unit. This unit was the 2/7th Commando Squadron, which had been placed under direction of the brigade commander, and to it was added within the month, two other squadrons of the 2/6th Cavalry Commando Regiment.

THE INLAND SECTOR

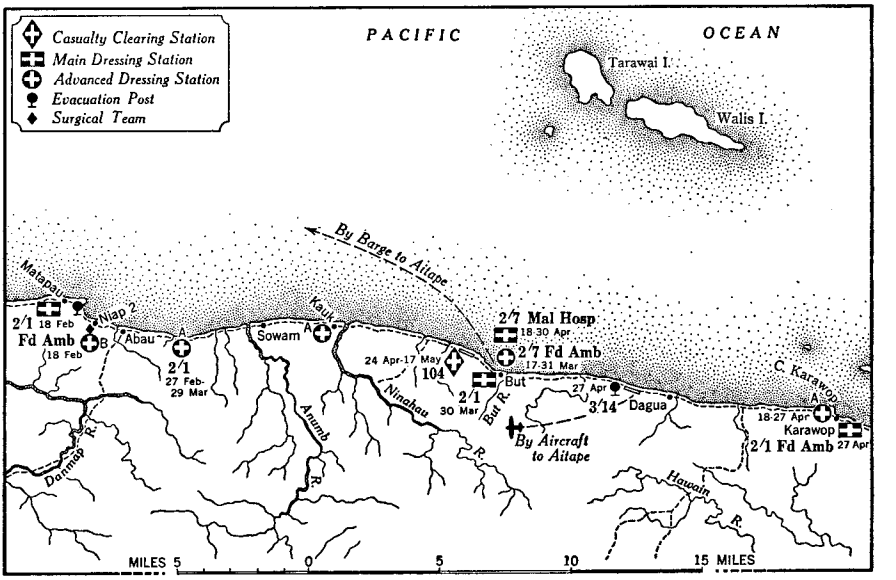
Meanwhile the 17th Brigade had begun its task of locating the enemy and was expelling them from successive villages on its line of advance. The 2/7th Commando Squadron, relieved from routine patrols by some of the brigade troops, was able to press on; it displaced the Japanese from the Bitika-Ami line by vigorous patrolling and on the 22nd occupied Bulamita. This advance had allowed the 2/2nd Field Ambulance to set up A.D.Ss. at Tong and Anopapi, late in December; early in January after the capture of Walum, surgical facilities were immediately made available. Captain D. B. Wightman, a surgeon detached from the C.C.S., went at once to the Tong A.D.S. with Major Parsons. Later, Major D. R. Reid went to Ami to help the A.D.S. there.

During February important advances were made on the inland sector, particularly with regard to the much needed control of the airfields. No serious incidence of malaria occurred sufficient to hamper the 17th Brigade, as the rate did not exceed 7 to 8 per 1,000 per week. Pressure was maintained on Balif, which was occupied on the 5th February, and the more important operations on Maprik were set in train with a wide sweep to the west and south. This was strongly resisted by the Japanese, who depended largely on the food produced in the extensive gardens of this area, and were aware of its strategic importance. The 17th Brigade in the early part of February was held up, and its advance temporarily checked by the non-arrival of essential supplies by air. Maprik, as well as having a good airfield, had been the centre of a district which supported large numbers of natives before the war, and its possession was highly desirable. The taking of Balif had already borne fruit in permitting air communication. Auster planes could land near the A.D.S., and a few days' work on the airstrip enabled patients to be flown out singly. For some months previously, the good work of Angau had helped greatly in preparing the natives for full cooperation with the forces. Movement of sick from this sector varied in difficulty; the evacuation route from Ami A.D.S. by track was very arduous for all but convalescents.

An advance on Maprik was planned by the 17th Brigade for early in March. This began on the 8th, and although the enemy resisted strongly, progress was made. On the 11th it was possible to close the A.D.S. at Tong, and less than a week later the brigade headquarters was established at Balif.

ON THE COAST

It was important for the forces on the coast to secure Dogreto Bay, as a safe landing point was necessary for maintenance of supplies by sea-borne craft, and also for establishing a centre for transport of casualties. On 3rd February the 2/7th Field Ambulance was able to set up an A.D.S. at Matapau, north of Dogreto Bay, and evacuations began at once from the point. On the same day six patients lying and fourteen sitting went back by L.C.T. with three others who were sent direct from the



surgical team at Niap. This was a relief to the 2/7th Ambulance, since there had been no recent evacuation at Aitape, and therefore patients sent by the coastal route for surgical attention had to be held in forward areas. It was not until 6th February that the Danmap River could be crossed by jeep. According to plan, the 2/1st Ambulance should have relieved the 2/7th, but was again prevented by the heavy continuous rain. The 2/1st had arrived on 2nd January at Aitape, and after opening east of the Danmap River on 14th February, sent a company to Niap to set up an A.D.S. This was equipped for surgical work, carried out by a team under Major F. W. Connaughton. Both lying and sitting patients sent from the M.D.S. at Matapau moved forward to Dogreto Bay where they embarked on L.C.T. at night. The 1st Australian Water Ambulance Convoy helped in these coastal evacuations. Once the 2/1st M.D.S. was running, the 2/7th Ambulance handed over the medical responsibility east of Danmap to the 2/1st, and withdrawing all their personnel west of the river, entered on a brief period of rest. During this time the unit looked

after 400 troops west of Danmap, and any others who came up over the inland route *via* Idakaibul. These patients were brought from the 2/3rd Battalion at Mina Creek by native carrier teams.

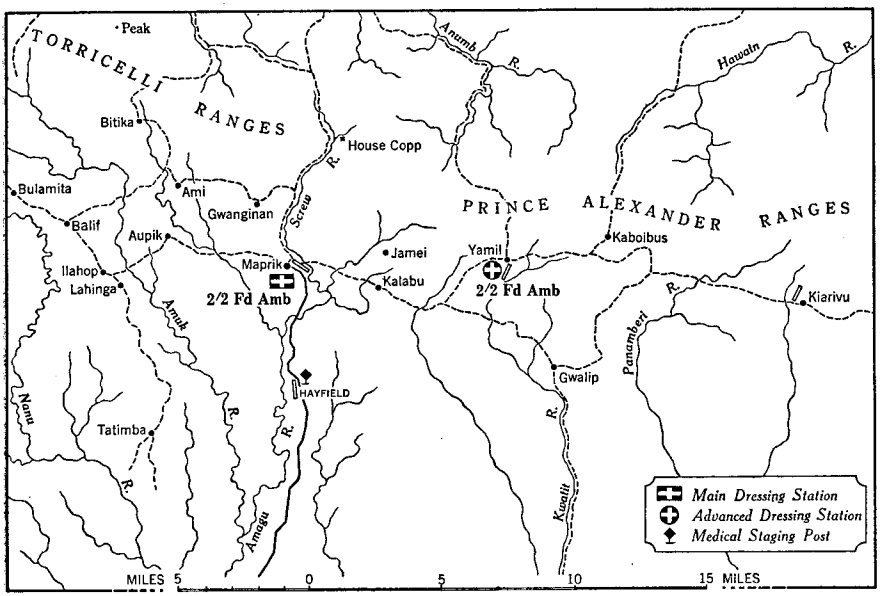
On the coastal sector there had been some heavy fighting at Nambut Hill since 7th February, the casualties from which had contributed to the crowding of the 2/7th M.D.S. during a period of bad weather. The area was not cleared of enemy until the 19th, when the 2/1st Ambulance had been able to relieve the 2/7th. Some further help was promised by the 3/14th Ambulance, which moved a company to Tumleo Island off the coast near Aitape to set up a convalescent depot. This was not opened till a little later, but was much needed, in particular for the numbers of men recovering from bouts of malaria.

During this period Colonel Fisher was returned to the mainland through illness, and pending the arrival of his successor, Colonel R. H. Russell, Lieut-Colonel Cameron of the 2/1st Ambulance acted as A.D.M.S. of the 6th Division. Unhappily Colonel Russell was killed in the crash of a plane which was also carrying Major-General Vasey, who was to have assumed command of the division, and Major-General R. M. Downes, who had been appointed as historian of the Medical Services.

Early in March the 16th Brigade, which still sustained the leading role in the coastal advance, continued to advance along the coast, and on 17th March captured But. Here the 2/7th Field Ambulance established an A.D.S., and was assisted by the 2/1st Ambulance in the medical work in the area. Major I. W. MacNaught and twenty-nine O.Rs. ran a small A.D.S. for the 2/3rd Battalion and the 2/6th Cavalry Commando Regiment, making available surgical treatment for cases of the urgent type, but bad weather still imposed obstacles to transport. In fact the heavy rain which fell in the middle of March made roads impassable: the road from the M.D.S. to Dogreto was so deep in mud that patients could not be sent through to the bargehead. The 2/7th Ambulance then had an M.D.S. at Ulau, and the only practicable road was through this by road to Aitape. Difficulties still persisted in moving patients over the wet muddy tracks, with their seemingly countless river crossings. Smibert's unit, the 2/2nd Ambulance, cooperated well in providing stretcher bearers to carry sick and wounded over the rivers. On the 21st Selby's ambulance returned to Aitape to rest, with the exception of those members working the A.D.S. at But. The maintenance of this A.D.S. was asked for by the brigade, in addition to that provided by a company of Cameron's unit at Kauk.

On 23rd March the 16th Brigade took over the responsibility of the coastal country west of But River, and then attacked Dagua, a settlement east of But with useful sea and air facilities. Dagua was captured, but the enemy resisted strongly for a time in the surrounding area, and was only subdued after hard fighting, which continued until 2nd April, when this coastal advance was consolidated. At Dagua the 3/14th Field Ambulance set up a staging post where walking patients would be held if necessary when awaiting transport.

At the end of March the 2/7th Ambulance ceased to administer the A.D.S. at But, which was then taken over by the M.D.S. of the 2/1st. In the preceding week 250 patients had been treated there, thirty of these requiring surgical care by the team; they were evacuated direct to Aitape by L.C.M. The strain of what was undoubtedly an exacting campaign, fought in highly malarious country, was recognised by the Commander-in-Chief when planning Australian participation in the landing on Tarakan, part of the operations on Borneo. It had been intended that one brigade



of the 6th Division should move from Aitape for this purpose, but as it was inadvisable to call on unrested troops of the 6th Division for another possibly prolonged operation, the 9th Division undertook this action.

OPERATIONS ON MAPRIK

During this phase of the coastal operations, the 17th Brigade was still active in the inland sector. Operations on Maprik successfully begun early in March, were strongly continued, and by the latter part of March Balif was cleared, as we have seen, and the brigade headquarters were established there. This facilitated further actions, in particular an outflanking sweep from the south, the aim of which was the complete subjugation of the Japanese in the area surrounding Maprik.

Evacuations from the 17th Brigade area were the responsibility of the 2/2nd Field Ambulance; a carrier route was in use from Lahinga and Ami through Walum and Suain, but seriously ill men could not be moved past Lahinga, where there was some banking up of patients. Further movement was by motor ambulance from Suain to the 104th C.C.S.,

which was still at Aitape, but arrangements were made to extend the airstrip at Balif so that Auster aircraft could be used with improvised fittings to take one stretcher patient. As the brigade penetrated farther to the south, it reached some of the higher ground of the foothills of the Torricelli Range past the swampy valley of the winding Sepik River. This was difficult and mountainous country. Only aircraft could give practicable and comfortable transport to sick and wounded men, for whom the only alternative was a long carry lasting a number of days. The first week in April marked the progress of evacuation from the varied terrain of the inland sector; from 5th April Auster planes took patients from Balif to But, where the 2/1st Ambulance took charge and sent them on by barge to Aitape. Seriously ill men likely to be adversely affected by this double handling were flown to Aitape direct.

April was a month of favourable endeavour in other ways in the inland sector. Strong resistance of the enemy in the Maprik actions was overcome, and on the 12th Gwanginan was occupied after the enemy had withdrawn, and by the 21st the twofold sweep of the brigade finally cleared Maprik. A few days later elevated ground east of the Screw River was taken, with access to an emergency landing strip. The enemy then began to withdraw farther to the north, and work promptly began on an airstrip, five miles to the south of Maprik, and hereafter known as Hayfield.

THE COASTAL SECTOR DURING APRIL

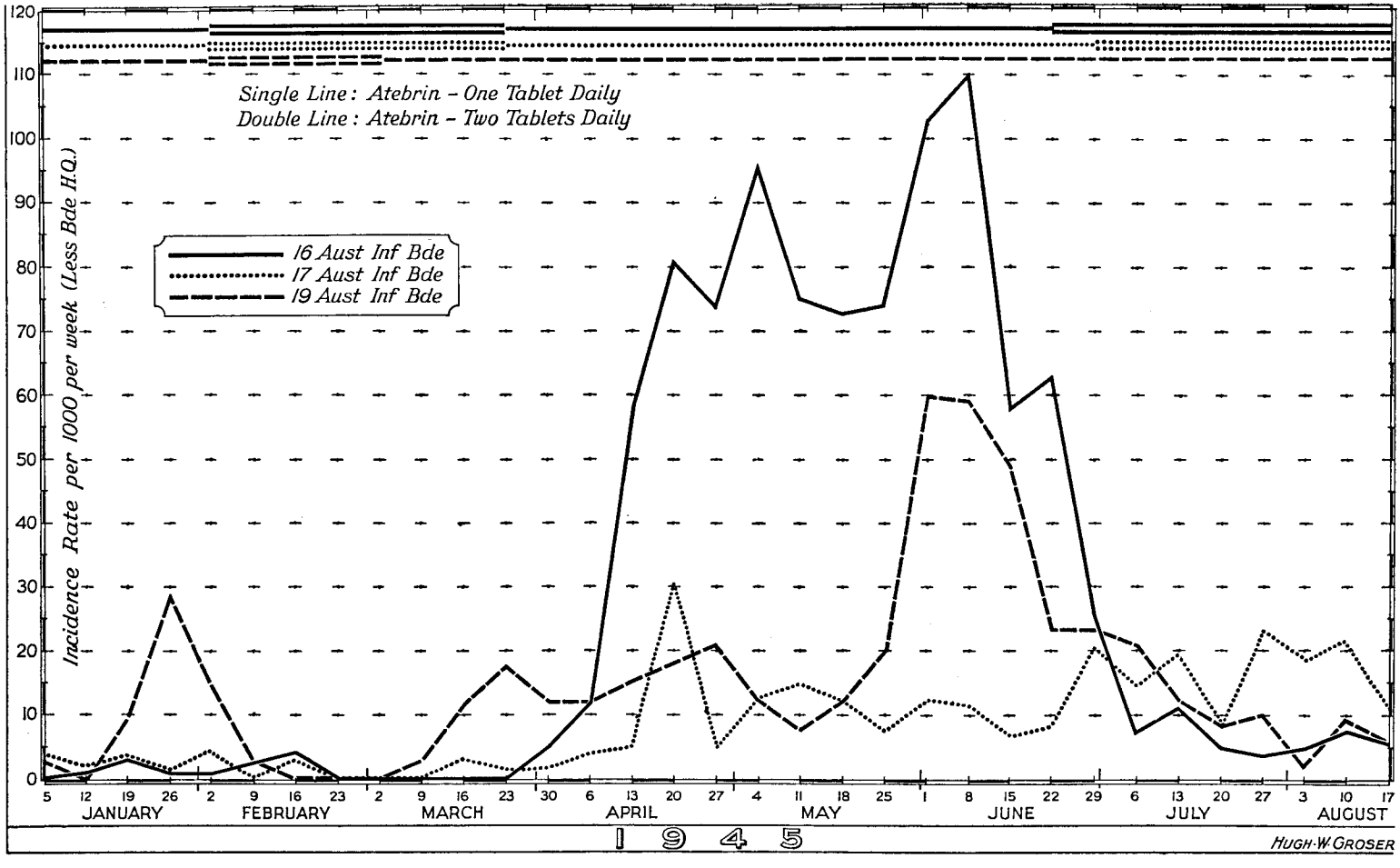
Early in April the staff of the 3/14th Ambulance began work at their convalescent depot on Tumleo Island. On the 9th the 2/7th Ambulance was sent to But where the 104th C.C.S. was preparing to occupy a site. Both ambulances were supplying different phases of a growing need, looking after the victims of malaria.

The advance along the coast was being energetically pursued by the 16th Brigade, which took Karawop on the 16th. Three days later, the 2/1st Field Ambulance established an A.D.S. at Karawop, and the C.C.S. moved to But, where the nurses were greatly missed, as they were detached to the A.G.H. The 3/14th Ambulance by this time had organised an air evacuation post at Dagua.

Brigade troops advanced on Boiken and Hawain River, and after heavy fighting reached Kalimboa. Further fighting was likely to be heavy in the later stages of advance on Hawain, and this continued till 29th April. The 2/3rd Battalion had moved through the 2/1st Battalion to capture Boiken and Kalimboa, and the 2/2nd Battalion repeated this manoeuvre with the 2/3rd, and went on to establish a bridgehead on the Hawain River, and to take Parom.

MALARIA EPIDEMIC

When the 19th Brigade took a double suppressive dose of atebrin (two tablets daily) for several weeks, the malarial outbreak affecting this formation in mid-December seemed at first to be coming under control.



Epidemic of malaria in Aitape-Wewak.

However, as we have seen, a sharp rise of epidemic type induced Stevens to place the whole division on a double dose on 29th January. The 19th Brigade reverted to the routine dose of one tablet daily at the end of February, but the 16th and 17th Brigades continued the double dose till the 22nd March. The result can only be described as greatly disappointing. The early days of April soon revealed that the rising rates shown in March were the harbingers of a true epidemic of malignant malaria. It appeared that, released from the assumed control bestowed by a daily dose of two tablets of atebrin, the 16th and 17th Brigades showed the classic phenomenon of the steep and high rise in the epidemic incidence of the disease. There was this difference: the 17th Brigade showed only a moderate rise, the herald of a mild outbreak; the 16th Brigade showed that a large-scale epidemic might be expected, with its swift steep rise and its cumulative nature. There was no reason to doubt that the cause of this difference lay in the greater abundance of adult vectors and the high transmission rate on the coast with its lower elevation and its heat and humidity.

The 19th Brigade showed a steep rise in its incidence rate also, but less marked and more irregular. This brigade had shared with the 16th the heavy tasks of the coastal campaign fought out on a difficult terrain full of physical obstacles, even greater in number and more difficult to overcome than those of the inland sector. Moreover the 19th Brigade had received its increased dosage of the suppressive drug over two divided periods. A controversial issue at once arose, whose reverberations shook the 6th Division, and are even yet potent to evoke discussion. Whether this epidemic was due to insufficient intake of atebrin, or to some other unexplained factor was not then determined, but it might well have been regarded as an ironic gesture of fate that after an initial threat which it was hoped could be countered, and immediately after the adoption of the most rigid precautionary anti-malarial measures as yet imposed on an army, an epidemic of swift onset and very serious dimensions should strike the division. Certain features were evident even at the onset. All brigades and the base sub-area were affected, though not to an equal extent; the predominant type was, as expected, malignant tertian; the nature of the attacks was mild and complications were rare; the anti-malarial discipline of the division was not flawless, in particular with regard to the destruction of adult vectors, but on the whole it had been satisfactory, since the search for and discovery of slips in the routines; the varied incidence in different formations was not inconsistent with differences in conditions of climate and terrain, and in all areas where troops were fighting the disease was hyperendemic, though the sporozoite rates were not unduly high.

When this epidemic first struck the force, Brigadier Fairley was overseas and was not able to begin investigations at once, but there was no dearth of authorities of high degrees of experience and capacity. Brigadier J. A. Sinton, a distinguished British malariologist, was in Australia and attended a conference on this problem. Both he and Lieut-Colonel Mackerras, the

entomological adviser of the Australian Army, as well as other experienced medical officers considered that there was a possibility that an "X" factor, not found in other areas, might exist which might prevent atebrin from suppressing malaria; in other words there might be a local strain of plasmodium resistant to atebrin.

As we have already seen, the routines adopted for the administration of suppressive atebrin were exceedingly strict; it was concerning these routines that sharp controversy arose. Many officers in the 6th Division, particularly medical officers, believed that it was possible in certain hyper-endemic areas to take one tablet of atebrin with complete regularity and yet to contract malignant tertian malaria. They pointed to distinguished victims whose care and honesty were unassailed. On the other hand, exponents of the official point of view maintained that the most careful and rigorous experiments in Australia had proved the power of one tablet of atebrin taken daily to prevent the development of overt malaria. There was evident conflict between the two points of view: this gave support to the hypothesis of the existence of a relatively atebrin-resistant parasite in the Aitape-Wewak area, the so-called "X" factor. In order to clarify the narrative we may here anticipate history, and state that a strain relatively resistant to atebrin was later proved beyond doubt by Fairley and a special research team to be present in the area.

On 19th February 1945 a Special Technical Instruction No. 120 had been issued from the Australian Medical Headquarters on the *Efficacy of Suppressive Atebrin.* The concluding paragraph ran as follows:

> Review of the experimental data and careful analyses of A.M.F. malarial statistics make it possible to state with certainty that malarial rates consistently in excess of the minimum must be attributed to some break-down in administration of suppressive atebrin.

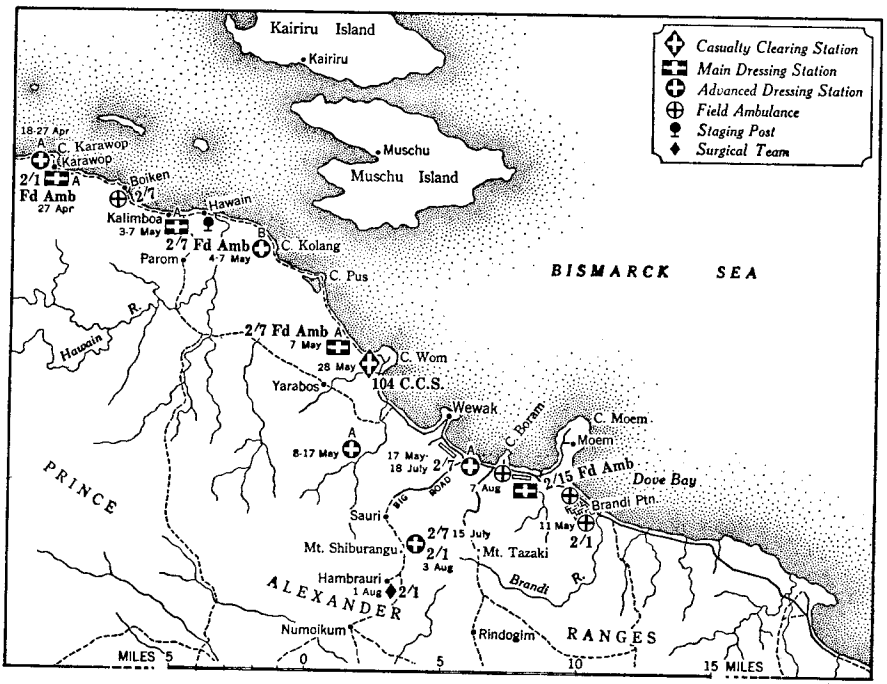
FURTHER EVENTS IN THE COASTAL SECTOR

On 3rd May the 19th Brigade passed through the 16th Brigade at Hawain River, and advanced to Cape Pus, and to Cape Wom on the following day. The 2/7th Field Ambulance established an A.D.S. at Kalimboa, and attached thereto a surgical team from the C.C.S., with Major A. Daly Smith as surgeon. A few days later Yarabos was captured, and the 2/1st Field Ambulance came forward and took over the Kalimboa A.D.S. These moves were all preliminary to the chief objective of the force, the taking of Wewak, and to this end, the 2/7th Ambulance moved up to Wewak west with its surgical team. This team began within a few hours to treat casualties from an accidental bombing of the 2/1st Field Regiment. The 2/7th Ambulance set up its M.D.S. at Cape Wom, one of four established during the campaign, illustrating the principle exemplified in New Guinea, that the role of field ambulances in holding patients need not be sacrificed to mobility, though its prime function is evacuation.

The 2/7th Commando Squadron captured Sauri Hill and then cut the main southward outlet of Wewak, known as Big Road. Fighting continued on Wewak Point but on 11th May the peninsula was cleared of

the enemy. A force known as Farida Force landed at Dove Bay with an A.D.S. from the 2/1st Field Ambulance.

The 19th Brigade pressed on. Boram was attacked on the 17th and Cape Moem taken five days later. Farida Force consolidated its position by capturing Brandi plantation and joining forces with the 2/8th Battalion south of Cape Moem. By the end of May the 19th Brigade had progressed far enough towards the foothills of the Prince Alexander Range to ensure a stable situation.



PROGRESS ON BOTH FRONTS

During May the 17th Brigade completed the work on Hayfield airstrip near Maprik, so that a month after the opening of the strip for Auster aircraft, Anson and Douglas transports were also landing. This advance accelerated and improved the medical service, as well as providing another avenue for supplies, and made possible safe and comfortable evacuation of casualties. During the remainder of May the 17th Brigade was engaged in active patrolling between the brigades inland and on the coast and made some advance towards Yamil.

Some sharp actions in the southern part of the inland sector took place in June, and these, combined with continued patrolling towards Yamil, led to the capture of this centre, and the southward villages were then cleared of Japanese. Jamei, a strong enemy centre, was captured earlier, but it was early in July before the Japanese were finally expelled from

the ridges. Constant patrolling ensured the safety of the flank of the steadily advancing force. Since the taking of Maprik and its surrounding areas, there had been a constant nearing of the two long prongs of advance, the 19th and 16th Brigades on the north coast, and the 17th Brigade in the Torricelli-Sepik areas to the south.

On 8th July the 2/2nd Field Ambulance moved its headquarters at Aitape to Wewak, though it still maintained an A.D.S. at Maprik. Further advances were made east of Yamil; several ridges strongly held by the enemy were cleared, such as Kaboibus Ridge, and still the advance proceeded. By a flank movement based on the Gwalip area Kiarivu was captured on 8th-9th August.

After the deeply regretted loss of Colonel Russell in March, Colonel D. M. Salter was appointed A.D.M.S. and arrived on 13th April. On 8th July Colonel Saxby arrived and took over from Salter, who became D.D.M.S. II Corps with the rank of brigadier. During the period of interregnum Major R. S. Day acted ably as D.A.D.M.S.

Meanwhile on the coast vigorous patrols of the 19th Brigade captured several Japanese strongholds, and three high positions in the foothills were taken within the last few weeks of June. These were Mount Kawakubo, Mount Tazaki and Mount Shiburangu. The last of these was captured on 3rd July, after an outflanking movement in very difficult country: during the action Captain Owen Williams, an outstanding R.M.O., was killed. These movements were successful, in spite of the continuation of the malaria epidemic.

FURTHER MALARIAL INVESTIGATIONS

At the very height of the epidemic, on 13th June, two experienced officers, Lieut-Colonel Jaboor, commanding the 2/2nd Field Regiment, and Lieut-Colonel Selby, commanding the 2/7th Field Ambulance, were instructed by the divisional commander to visit II Corps and 3rd Division on Bougainville, and 5th Division on New Britain, in order to find out details of the measures of malaria prevention adopted in these areas, and if possible, to discover any additional precautions which could be applied with advantage in the Aitape-Wewak sector. All possible assistance was given them in their enquiry.

Their most useful findings were in the Solomons. Here they visited fifteen units and headquarters on Bougainville, and found that increased doses of atebrin, even up to twelve to fourteen tablets a week were being taken on occasion. They found that the temporary increases were sanctioned by the D.D.M.S. II Corps, the A.D.M.S. of the 3rd Division, commanding officers and regimental medical officers, each within his own jurisdiction, and without effecting any permanent change in general policy. Men on patrols complaining of headaches or similar disorders, or those reporting at R.A.Ps. were given additional atebrin with good effect. Jaboor and Selby considered that the malarial discipline in the Solomons area was little different from that in the Aitape-Wewak area; in fact, special precautions adopted in the 6th Division, such as the use of night

mosquito picquets, or insect repellent routines at cinemas were not practised in the 3rd Division area. During the tour breaches of dress regulations were observed not infrequently.

The delegation reached the conclusion that on Bougainville, by using an increased dose of atebrin when a higher incidence of malaria was observed in a unit, the immediate rise could be controlled. Colonel Wallace, the A.D.M.S. of the 3rd Division believed that "the best weapon placed in medical hands is the optional use of two atebrin tablets when considered necessary by the S.M.O. of a formation". This opinion, shared by the delegation from the 6th Division, squared with the findings in this division with regard to the incidence of malaria in officers: it was found to be proportionately only half that of non-commissioned officers and men. Surely it was not unnatural that, official rules notwithstanding, officers threatened with an overt attack, which might initiate disciplinary action, should take increased quantities of the suppressive drug to avoid obvious infection. Jaboor and Selby found that the same practice existed in other areas also, and that comparisons based on the standard daily dose of 0.1 gramme were illusory.

They observed too, that their own conditions in New Guinea were not comparable with those existing in other parts. The Bougainville campaign was a corps operation, with an opportunity to "call the tune" with the enemy, and with better provision for supplies and transport, until the continued bad weather prevented further active operations on any large scale before the Japanese capitulated.

In New Britain the nature of the campaign was again different; it was largely a problem of containing the enemy within fixed defences, without sustained fighting.

The Borneo campaigns were again different. They were part of the grand plan, with problems of logistics solved, and full sea and air cover. In fact, the medical operations were an excellent demonstration of preventive medicine made possible on a large scale.

The delegation returned to the 6th Division with a conviction that, notwithstanding faithfulness in all methods of personal protection, an efficient dose of atebrin must be taken, and that, to be effective, this dose under certain conditions might have to be increased beyond the amount prescribed as adequate for suppression. What those conditions were could not be determined with certainty, but Jaboor and Selby were impressed with the practical methods adopted on Bougainville, which aimed at increasing the blood-atebrin levels when circumstances dictated the need for more active suppression. It was of interest that legalised increases in the daily atebrin dosage did not cause any defections in discipline or fall in morale.

EXPERIMENTS AT CAIRNS

When Fairley returned from overseas he was instructed by Blamey to proceed to the Aitape area and investigate the outbreak of malaria. He took immediate steps, and organised the formation of a field section

of the Land Headquarters Medical Research Unit under Major I. C. MacDonald, with Major J. I. Tonge as pathologist and a technical staff. Lieut-Colonel Mackerras was appointed malariologist to First Army and studied the problem from the epidemiological point of view.

Fairley and his team, in June, set about the solution of a number of technical problems relating to the suppression of malarial infection in the 6th Division. These included tests of the atebrin used in the field, to determine the exact quantity in each tablet, and its physical and chemical composition, and the average levels of atebrin in the blood plasma in men reputedly taking standard dosage. This enquiry showed that the atebrin as supplied complied with all standards, and produced the concentration in the plasma theoretically needed for adequate suppression of malaria.

Examination of the blood of men of the 6th Division under treatment for M.T. infections, particularly those suffering from recrudescent attacks, revealed that standard concentrations of atebrin in a certain proportion of cases failed to suppress M.T. malaria regularly, or to cure it satisfactorily, when compared with the usual experience while maintenance atebrin was being taken after a standard course. Fairley's experiments afforded definite evidence of the presence of an M.T. strain relatively resistant to atebrin. No proof was discovered of a similar strain of B.T. parasite. The proportion of M.T. parasites with this biological character was not exactly determined. The patients used for these tests were those who had had several recurrent attacks of M.T. in spite of standard treatment. The phenomenon was irregular in nature, and it seemed that varying grades of atebrin-resistance existed. Some strains failed to be controlled by a dose double the usual amount. The suggestion was made that a certain instability in behaviour of this relatively resistant strain might be associated with the recent acquirement of the property of resistance.

Fairley concluded that at least 90 per cent of the force were infected with malarial parasites, but that only 23.3 per cent contracted overt malaria. He pointed out that the selective nature of the patients investigated, marked them out as exceptional experimental material, and not typical of malaria as seen in Aitape-Wewak. The results of investigation of a large series of men selected at random, sufficient in size to be more statistically representative, perhaps would have been interesting and significant, but prompt answers had to be supplied to the important questions posed in the area, and time was pressing. The cessation of hostilities during August somewhat curtailed the enquiry from the research point of view.

Braithwaite had also carried out some work on experiences with blood transfusion, and found some evidence in favour of the presence of a resistant type of *P. falciparum* in the Wewak area, but was not able to publish this till the war was over. *P. vivax* might have been investigated further had there been time and opportunity, in view of the much higher incidence of this type in Aitape-Wewak than in other areas and the

greater readiness with which it can be suppressed. Work was done later on four volunteers, but only one *vivax* strain could be tested experimentally.

The origin of the resistant M.T. strain could not be determined, but later work of Mackerras and Aberdeen suggested that if the quality of atebrin-resistance was acquired and not inherent, it seemed on epidemiological grounds unlikely that this strain was produced among the troops but rather among the Japanese. Mackerras after his appointment as malariologist to First Army pointed out the very real danger of stationing troops near native villages where children congregate.

An important feature of the outbreak of M.T. was the clinically mild nature of the disease. Few complicated or dangerous attacks were seen, showing, it may be assumed, that atebrin at least modified the symptoms and also that it must have been taken and absorbed for such an effect to be produced.

THE ARRIVAL OF THE 8TH BRIGADE

This episode demands special mention for its bearing on the malarial problems of Wewak.

Near the close of the Aitape-Wewak campaign the advent of a reinforcing brigade in the area was welcomed not only for its assistance, but as a practical test of the effect of the local malarial conditions on a newcomer to the area.

During July and August the epidemic in each brigade of the 6th Division was steadily disappearing, though it appeared to be lingering in the 17th rather more than in the others. The usual dose of atebrin was restored on 15th August. During August the medical units worked chiefly from the Wewak centre; the 2/7th Ambulance was concentrated at Cape Wom on 2nd August, and the 2/15th Field Ambulance had an M.D.S. in the Wewak area. This unit, under command of Lieut-Colonel L. G. Hill, appeared over the horizon late in the campaign, and on 14th July acted in support of the 8th Brigade, which was sent to take part in the operations of July-August. The ambulance sailed from Matupi and disembarked at Wewak. On the 16th an A.D.S. supported the 35th Battalion at Brandi plantation, and on 6th August set up an R.A.P. which took patients from the 16th Brigade area and from the R.A.A.F. advance party as well as from the 8th Brigade. By the 7th the 2/15th M.D.S. was working and carrying out surgical work. Lieut-Colonel A. C. Mendelsohn took over later in the month from Lieut-Colonel Hill.

The 8th Brigade's appearance in the Wewak sector aroused considerable interest by reason of its previous malarial history and record in hyperendemic areas. It had advanced up the coast to Madang during an earlier phase of the north coast operations, and went on to Alexishafen and Hansa Bay, country of the same type as the coastal sector of Aitape-Wewak. After a doubtful start the brigade had maintained an excellent anti-malarial record. It had as many as 275 and 110 cases of malaria in its 30th and 35th Battalions respectively during the early months of

1944, but, with improved protective methods during the past year, had not had more than thirty cases in either battalion. Within three or four weeks of their arrival at Wewak, both battalions showed an increase in the rate of incidence, the 35th Battalion suffering a rate of 38.6 per 1,000 per week in successive weeks in August. Hill remarked on the appearance in the area of the 8th Brigade that "at the time the malarial discipline in Wewak was good, and the occurrence of malaria in troops who had successfully evaded it in the swamps of the Ramu and Sepik deltas where they depended on themselves for their preventive practice, was to say the very least, devastating".

Following the administration of two tablets of atebrin a day the disappointingly high incidence rates fell to a mere one or two cases a week. It cannot be exactly stated to what extent a strain relatively resistant to atebrin was a major factor in this outbreak in the 8th Brigade, but there seems no doubt that the brigade was attacked by the same atebrin-resistant strain as the division, and the evidence is strongly against any assumption that disciplinary failure played any significant part.

ADMINISTRATIVE PROBLEMS

The solution of the problems raised by the Aitape-Wewak epidemic was not solely a question of science. Like many service problems it also involved administration, as was obvious from the beginning. The divisional commander's conference showed that opinion was divided and that two opposing factions existed. One rested its basis on the suppressive dosage laid down by Fairley on the strength of his accurate and careful experimental work at Cairns, and ratified at the Atherton conference as the officially accepted dosage of suppressive atebrin for the Australian Army. This faction was unwilling to countenance any suggestion that 0.1 gramme of atebrin daily could fail as a suppressive, and believed that actions based on this admission would cause a fall in morale in the men, who might feel that they had been misled. The other faction would not accept the implication that the troops were failing in carrying out the rules of personal protection. This view was supported by many capable and observant officers, who were confident that numbers of men had carried out their protective measures faithfully and nevertheless contracted malaria, despite a regular dosage of atebrin in prescribed amounts. They felt that lack of faith in the men by the officers would have a much more serious repercussion on morale and therefore objected to unnecessarily strict additions to the existing atebrin drill. They pointed out that some of the men were already disposed to regard atebrin as fallible, and increased dosage would not prejudice the men against their advisers.

After Fairley's return the answers to the important questions involved were soon obtained, and the hypothesis was proved, that in addition to the usual atebrin-susceptible strains of parasite, an atebrin-resistant plasmodium was present in the area.

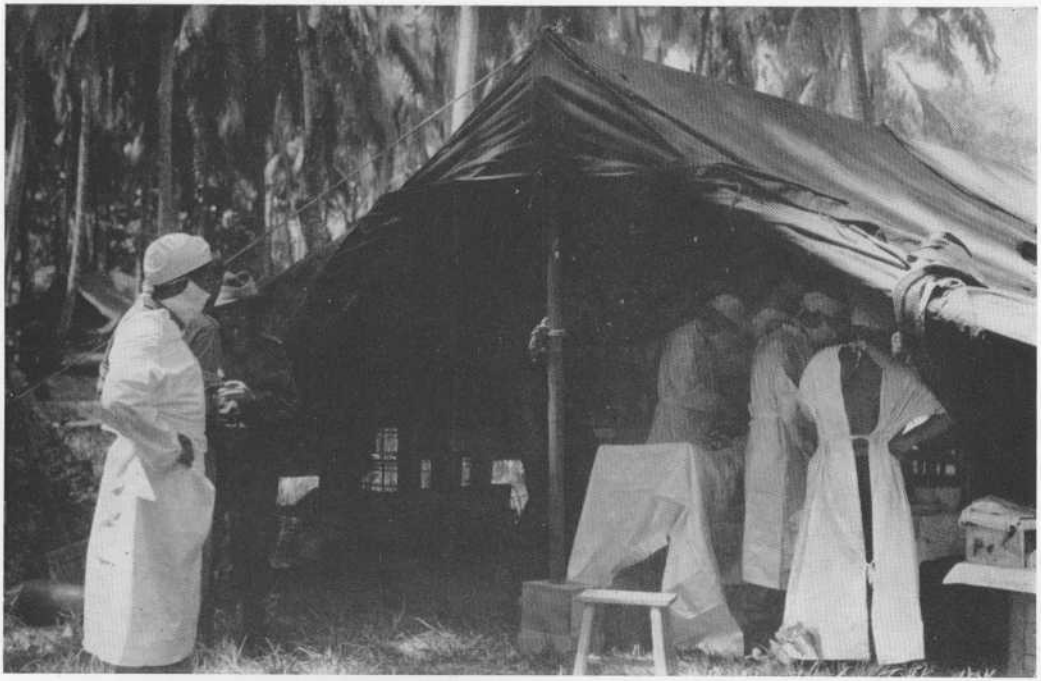
Now that this knowledge was gained, what was the next administrative step? Unfortunately controversy did not die quietly, for, as will be found

on more detailed study of the technical questions arising from the enquiry, exact answers could not be given to all these. Further, if a careful increase in the regular dosage of atebrin was to be adopted as an important measure, how could this be done without admitting that the previously taught dose of 0.1 gramme daily was not invariably sufficient in the area? What doors of indiscipline might be opened if adherence to the official dose of atebrin was varied? What difficulties of administration might be met? These were not serious drawbacks, but more serious was the implication that men of the 6th Division were themselves at fault, and were therefore forced to take more atebrin because of failure to observe the strict rules of prevention.

Perhaps it was unavoidable that a certain slur, or at least some degree of reprehension should lie on the division, but numbers of officers and men felt keenly that they had been blamed without due cause. In particular, those who had looked forward to the honour of participating in further operations after a period of hard training and harder campaigning were greatly disappointed. In spite of this the division accomplished more than was expected of it when it entered the area.

Perhaps the greatest lesson of this episode was that the uprising of a drug-resistant strain may occur, and modern teaching advises that suppression of malaria should not rest on one drug alone. Had paludrine been available at the time the trouble would not have occurred, for this and other new anti-malarials were later proved by Fairley to be effective against the strains resistant to atebrin. In the light of history it seems just that the 6th Division should be exonerated from the charge that lack of discipline in itself was the major cause of the epidemic. Some of the experimental evidence suggested that the non-taking of atebrin accounted for a proportion of the cases, but this evidence was hardly complete enough to prove that such proportion was substantial. The experience of the 8th Brigade is here relevant. No doubt there were faults and omissions in the division; there were also those who sought deliberately to evade rules, but these were few and not representative.

It may be admitted that certain technical medical matters may not be wisely or widely disclosed during a state of war. Even in the ordering of a large military formation to take a fully effective dosage of a valuable drug such as atebrin there is a definite responsibility, for all valuable therapeutic substance may be expected to have some toxic properties. Atebrin was a most valuable drug, singularly free of toxic effects in therapeutic doses, but prolonged administration of a dose double that known to be an adequate suppressive of malaria was not without risk of sequels. Certain effects like rare disturbances of the liver, the blood-forming organs, and the nervous system were known. The uncommon though troublesome "tropical lichenoid" skin eruption was known by the medical advisers of the armed Services to be due to atebrin, but this was not generally disclosed. For a time it was perhaps one of the best kept medical secrets of the war. There was never any cause for alarm; many other substances are used daily by persons who are prepared to risk rare sensitivities, but



(Australian War Memorial)

Field surgical team, Tarakan.



(Australian War Memorial)

The dressing station soon after the landing on Tarakan.



(Australian War Memorial)

Aircraft spraying the Tarakan airstrip with D.D.T. for the control of malaria.



(Australian War Memorial)

Battle casualties being carried on to a L.C.M. at Balikpapan from which they were transferred to the 2/2nd Hospital Ship, *Wanganella*.

a whispering campaign could have lost the medical services one of its mainstays, at that time irreplaceable, and would have seriously prejudiced the course of the war in the tropics. For these reasons double atebrin dosage, a valuable saver of man-wastage, was used only in moderation, and over controlled periods. The atebrin controversy was, of course, somewhat different, for there was involved also a question of blame, which was not entirely a scientific question. There are psychological lessons too, whose sharper features are still prominent in the minds of some of those who played a part in a worrying and responsible experience.

It was a pity that some of the responsibility laid on the division for the high incidence of malaria could not have been lightened. Morale, as leaders know, depends on confidence, and without risk of indiscretion a certain amount of knowledge, disclosed only to trusted officers, might have mitigated some of the bitterness that was undoubtedly felt by them. The opinions of the D.A.D.H. of the division, who saw these happenings from an intimate level, are of some interest.

Major G. Read, D.A.D.H. of 6th Division, in reviewing the whole position, pointed out that as Fairley had shown both in the 3rd Base Sub-area and the division, atebrin had been partially successful as a suppressive in spite of the disappointing case incidence, since one of its effects had apparently been to lower the severity of the infection, even during a long and tiring campaign. The A.D.M.S. of the sub-area found at one stage that rises in the malarial rate were associated with slackening of disciplinary detail, and attention to these was followed by a fall. The personnel of this area, both while in Aitape and Wewak, took throughout the standard daily dose of one tablet, and a large proportion of individuals of both the sub-area and the division remained suppressed, particularly with regard to the *vivax* infection.

The outbreak in the division was unexpected, and contrary to other experiences with a force taking suppressive atebrin. Read found the work of the control units was excellent, in particular that of the 2/4th Malaria Control Unit, and supplies of material were adequate except for some shortage of D.D.T. He finally concluded that "the intellectual and emotional attitude towards suppression and prophylaxis of malaria has been shown to be a factor of considerable importance. To what extent a lack of detachment prejudices anti-malarial activities and affects the case incidence is a matter of opinion, but the D.A.D.H. thinks it is considerable. However, it has been encouraging to find a calm attitude in other ranks of the formation." Yet it would be idle to refuse to recognise that there were two schools of thought both in and out of the division and that a definite degree of tension existed. It was, of course, fully understood by all concerned that all the factors of hyperendemicity were present in the area. The division had everything to lose by faulty discipline, and measures were taken very promptly to locate and deal with the faults. Certain weaknesses were detected in the implementation of the rules laid down for the control of malaria in the field. There is no proof that these were either more frequent or more serious than those observed in other formations.

This was confirmed by the visit of the 6th Division delegates to other areas. The actual drill evolved for use in atebrin parades in the 6th Division was undoubtedly harsh, and in the belief of most medical men, tended to lower confidence of troops in their advisers. It seemed as if the empirical practice found effective in the 3rd Division and elsewhere might have given better occasional results, in spite of the official and scientific objections which might be raised to it.

FINAL ADVANCES

Concerning the military story of July and August there is not much to tell, though this phase of the operations foreshadowed successful strokes against the enemy.

During mid-July the 19th Brigade was advancing on a steep hill known as the Blot, south of Mount Shiburangu, and on Hambrauri. To help this advance the 16th Brigade was ordered to make a show of strength in the Yarabos area. Stiff fighting followed, and with help from air and artillery attack these features were captured. On 21st July the question of fatigue in the 17th Brigade was raised and the divisional commander decided to relieve the 17th by the 19th, and to complete the movement by 7th September. Meanwhile the 19th Brigade was also given some rest by the relief by the 16th Brigade, which took command of the area on 29th July. Using flame throwers this brigade cleared the southern slopes of Numoikum Ridge, and captured Rindogim. On the inland sector the 17th Brigade traversed difficult country, and after taking the Kiarivu strip occupied the neighbouring area with support from aircraft on 11th August.

The sands of the war were now running out, and following rumours of an armistice came the news of capitulation of the whole of the Japanese forces on 15th August. Australian troops at that date had reached points on the double-pronged lines of attack separated by only sixteen miles.

During the nine months' campaign the forces had driven from Aitape to Wewak, seizing *en route* all the strategic points of sea, land and air, and had pressed south from Wewak and west to Forok Point. On the inland sector the force had advanced forty-five miles from Tong to Kiarivu, and had by tactical operations and direct advances cleared the Japanese from an area of 3,000 square miles. Australian battle casualties for the campaign were 428 killed and 1,124 wounded.

Had the end of the war not come when it did the 6th Division's plans would soon have borne fuller fruit, the capture and holding of the northern part of the Mandated Territory from Madang to the border of Dutch New Guinea. These plans were not fully realised, but the operations which began largely as training for other and wider ventures had expanded, with the consent of the Commander-in-Chief, into an arduous campaign. This the division had conducted with notable success, in spite of the handicap of a large-scale epidemic of malaria.

CHAPTER 16

BORNEO

PREVIOUS accounts have shown how formations of the Australian Military Forces under command of the First Australian Army, were engaged in campaigns designed to destroy or neutralise Japanese forces in the Mandated Territory and the Solomons. Further tasks awaited a corps of two Australian divisions which was to share in the onward drive of the American forces under General MacArthur. By the end of August 1944, it was evident that these two distinct roles necessitated a change in the system of the Australian command. General Blamey as Commander-in-Chief had his Advanced Headquarters in Brisbane, and controlled operations of the oversea forces from this centre. Liaison with the General Headquarters of the S.W.P.A. was established by proximity of the two headquarters and close mutual discussion concerning planning and operational matters.

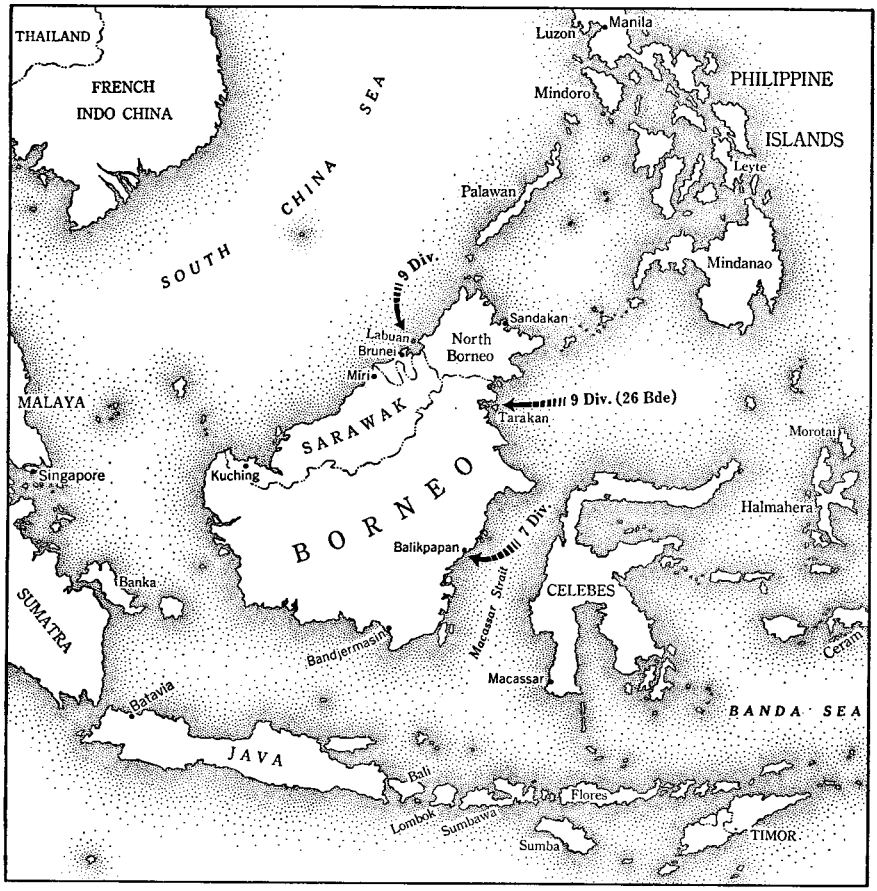
As the American forces were now about to advance to the Philippines, MacArthur moved his headquarters to Hollandia with the purpose of moving it still farther as his forces advanced against the Japanese. To ensure further close contact between the Allied forces Blamey moved part of his Advanced Land Headquarters to Hollandia, which was intended also to act as a staging area for I Australian Corps. Early in September a forward Echelon of Land Headquarters was opened in the Hollandia area to maintain liaison with MacArthur's General Headquarters, and by the end of the year the whole of the Advanced Land Headquarters had moved from Brisbane to Hollandia. This headquarters under Lieut-General F. H. Berryman, Blamey's Chief of Staff, controlled all operations of the Australian Military Forces outside Australia. Subsequent moves of MacArthur's headquarters were made as the American forces advanced into the Philippines, until in April 1945 it opened in Manila, followed by the Australian Forward Echelon Land Headquarters later in the month.

After gaining bases along the northern coast of Dutch New Guinea and on islands off that coast, MacArthur made a further advance to Morotai Island in the Molucca Group. This new base was soon under control with very little opposition, and gave the American forces a clear line to the Philippines, for the invasion of which extensive preparations were soon to be made. These movements left behind Japanese forces in New Britain, Bougainville and the Aitape-Wewak area, the neutralisation of which was to be placed in the hands of Australian divisions.

After several changes of plan the tasks finally allotted to I Australian Corps commanded by Lieut-General Sir Leslie Morshead were: a brigade group of the 9th Division was to capture Tarakan, the remainder of the division undertaking operations on Brunei Bay and Labuan Island, while the 7th Division would capture Balikpapan. Planning teams from I Australian Corps, 9th Division and 1st Base Sub-area were brought forward

to Morotai on 1st March. Morshead and the planning staff conferred with Blamey and his Chief of Staff at Leyte.

Decisive blows by the American and Allied naval forces had resulted in the capture of Manila in February, landings on Iwo Jima in February, and, on 1st April, American troops landed on Okinawa. This cut off Japan's

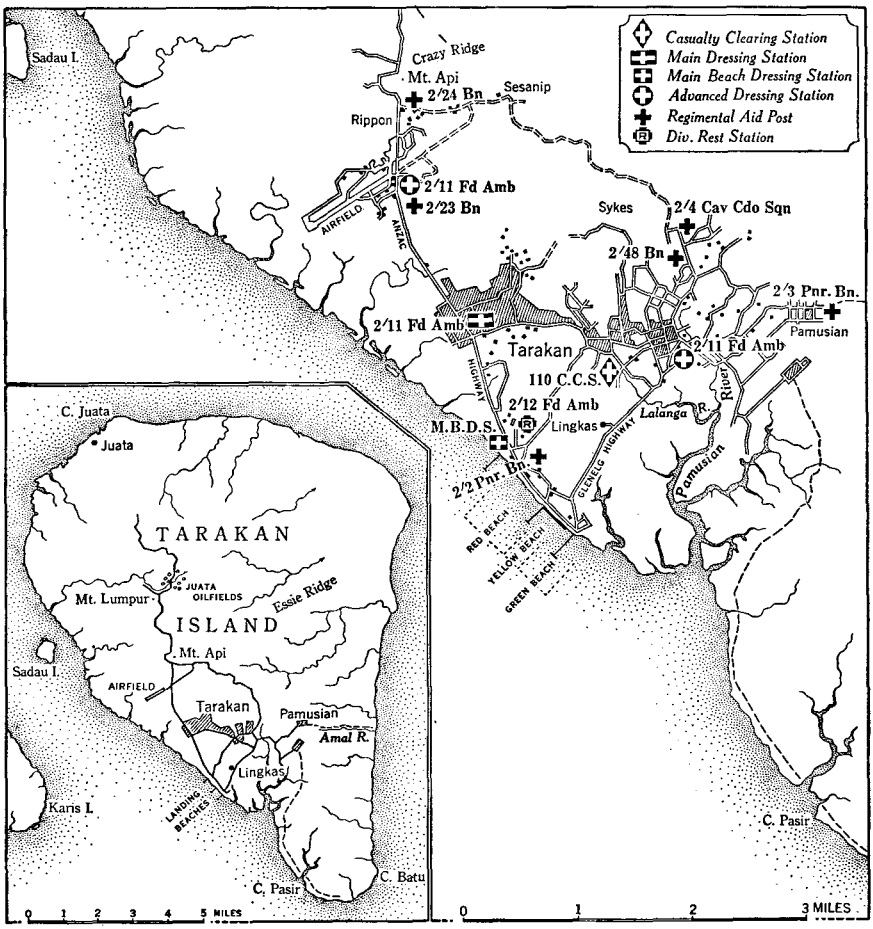


sea route to South-East Asia and the Netherlands East Indies, and restricted the role of the Japanese sea forces to defensive convoys and a certain degree of concentration in the Malay Archipelago. Further air bases on the western islands of the Philippines Group were secured by the Eighth United States Army and airfields were now held within fifty miles of the North Borneo coast.

The bases set down for attack by operations in Borneo were of great importance by reason of their value as sea and air bases and their oil refineries.

TARAKAN

Changes and postponements of dates were inevitable, as so many factors were involved in an Allied Combined Operation. Finally the target date for the invasion of Tarakan was set at 1st May (P-day), in order to take advantage of the higher tides, which would offset somewhat the shallow approach to the landing beaches over deep mud. I Australian Corps, using the 26th Brigade Group, was assigned the task of taking and holding



the island, and to overcome the enemy so that the Allied naval and air forces might be able to further the operations of the corps. On 11th April a final conference examined the coordinated plans of the three Services; these were approved by the commander of the I Australian Corps. A rehearsal of the main landing was carried out at Morotai on 19th April without beaching landing craft, as there was no suitable beach. All

operations were mounted from Morotai. The code name for this operation was Oboe 1.

Anti-submarine patrols were provided on the approach route and air support was given by strikes on appropriate targets for several weeks beforehand. Ground defences were attacked and such of the oil installations as would be used by the Japanese. In addition the Allied air forces provided cover for the Naval Task Force and convoys, and supported the landing and associated operations. The airfield on Tarakan was on a road of access, known as "Anzac Highway", which ran to the neighbouring Lingkas beach and was unserviceable owing to damage inflicted by Allied air attacks on the neighbouring airfield.

Sea approaches were treacherous, but it was essential that access be ensured early. This was of particular importance to the medical services, as the establishment of an L.S.T. area offshore was desirable during the early phases of the action, in order to provide for evacuation of wounded. Naval units in support of the Tarakan operation included the light cruiser H.M.A.S. *Hobart,* destroyer H.M.A.S. *Warramunga* and landing ships *Manoora* and *Westralia.*

A preliminary operation was planned for the day preceding P-day in which low-level attacks were made against obstacles, and on P-day medium and heavy strikes were directed against the beach area and known enemy gun positions.

The medical units allotted to the brigade were: the 2/11th Field Ambulance under command of Lieut-Colonel S. J. Douglas; the 2/12th Field Ambulance, commanded by Lieut-Colonel N. H. Morgan; the 110th C.C.S. under command of Lieut-Colonel W. V. Russell, and the 2nd A.A.M.C. Company, Beach Group. Two weeks before the operation began on Tarakan the 2/4th A.G.H. opened at Morotai.

Morgan acted as S.M.O. of the force, and the A.D.M.S. of the 9th Division was Colonel W. W. Lempriere. The beach maintenance area was under control of the 2nd Beach Group, and detachments from the 1st Base Sub-area were included to assist the development of a base until this could be handed over to a garrison force. The total strength of the land assault force was 11,804. The A.A.M.C. Company, Beach Group was a new type of unit introduced early in 1944 to meet certain needs felt in amphibious landing operations and had a War Establishment of five officers and seventy-four O.Rs. Two surgeon specialists were included in the establishment.

As a preliminary to the assault operation, the 2/4th Cavalry (Commando) Squadron and a field battery made a landing on Sadau Island, a small island between Borneo and Tarakan. This was designed to support the main landing to be made on the next day on beaches in the Lingkas area. It was unopposed by the Japanese.

LANDING ON TARAKAN

An hour before sunrise on 1st May, P-day, and preceded by a severe bombardment from naval ships and the 2/7th Field Regiment on Sadau

Island and strikes by aircraft, the 26th Brigade Group landed on Tarakan. A detachment of "B" Company of the 2/12th Field Ambulance accompanied the commando squadron in its landing on Sadau, but had no casualties to treat. No enemy troops were found on the island and the ambulance detachment moved to Tarakan two days later.

The assault landing on Tarakan was made simultaneously on Green and Red Beaches. All the tracked landing vehicles were allotted to the 2/23rd Battalion and the L.C.V.P. (landing craft vehicle for personnel) to the 2/48th Battalion. The facilities for a landing assault on Tarakan were few. The only suitable beach was about a mile in length, flat, soft and muddy, and at high water exposed only a strip which, though firm, was narrow. Lingkas beach was sub-divided into three parts, Green, Yellow and Red Beaches. The approaches were difficult, for the interior of Tarakan Island was hilly, and the Japanese had set many mines and obstacles on the beaches and farther inland.

MEDICAL ARRANGEMENTS

Two sections of "A" Company of the 2/11th Field Ambulance with Major R. A. Douglas and Captain A. G. Rowe landed with the battalions, but the sections with the 2/23rd Battalion were unable to land owing to beach difficulties. The beach area was very congested, especially in the part selected for the main beach dressing station. Major F. D. Williams established a medical post with "A" Company of the 2/12th Field Ambulance and a surgical team with the 2nd A.A.M.C. Company, Beach Group for urgent cases. This detachment was of help in relieving pressure on the medical company at critical stages. The S.M.O. directed that all casualties were to be evacuated to L.S.T., which had surgical teams, and were to be held at the beach dressing station only if unable to be moved.

In all areas the progress of the infantry was slow, as the enemy opposed them strongly with fire from well concealed positions. Next day resistance continued and shells were falling too close for comfort near the field ambulance. The collection of casualties was difficult and dangerous, and their number was heavy in some areas.

The M.B.D.S. was again hard pressed with work, and the 2/12th Field Ambulance had a surgical team attached to it. There were numerous small native cottages in the area, and in one of these the 2/12th Ambulance on 3rd May had set up a resuscitation centre, where a plentiful supply of stored blood was to hand. Some of these wounded required prompt transfusion and the Julian Smith direct blood pump was found very useful for rapid giving of blood. Two surgical teams were working there, and men requiring only minor surgery were sent back in L.S.T. surgically equipped. Jeeps were used for the transport of wounded, although the enemy were only 300 to 400 yards distant.

The numbers actually handled by L.S.T. were much below their theoretical capacity; they usually stopped receiving after taking fifteen surgical cases, and resumed after six to eight hours. The 2/24th Battalion advanced along the Anzac Highway towards their objective, the airstrip,

while the 2/48th Battalion progressed on the flank. When the situation was clear the M.D.S. was moved to a group of small native huts and set up in an old native hospital near the crossroads. The dressing station was still too close to the fighting but there was no alternative. During the evening of the 3rd, the 2/24th Battalion sustained over forty casualties near the airstrip. The road was under fire and collection of casualties was very difficult; tanks were used at first, until later, when jeep ambulances could be used to transport the remaining wounded.

The 110th C.C.S. had attempted to land its heavy section from an L.S.T. on Green Beach on P-day, but was thwarted by enemy artillery fire. Next day, the heavy section was successfully landed. On the 3rd, the C.C.S. was sited in the M.B.D.S. built up area, which contained a large number of small concrete cottages, and after spraying with D.D.T., occupied them for surgical work. Majors J. W. Sangster and C. H. Horsley were attached to the dressing station for theatre work. The close proximity of the enemy snipers on the ridge nearby and the possibility of infiltration made it necessary to cover all approaches at night. Major W. B. Dorsch of the light section was brought ashore and with Captain W. F. J. Cammack acted as assistant to the team, which was attached to the 2/11th Field Ambulance M.D.S.

On the nights of the 4th and 5th the Japanese came in as close as 200 yards to the M.D.S., and working conditions were most difficult. Small arms fire sometimes cut the power lines, and periodic outbursts of artillery added to the noise and discomfort. The diarist of the 2/11th Ambulance tersely remarked that "no M.D.S. could have been nearer the front line". The 2/23rd Battalion came up on the left flank to assist the 2/24th Battalion to capture the airstrip, and an A.D.S. was set up on the strip to control the handling of casualties from the battalions. The commando squadron was finding it hard to expel the Japanese from Tarakan Hill, and on 5th May Captain D. L. Thomas, R.M.O. of the unit, was severely wounded. By the end of this day Tarakan Hill was cleared, and the force thus gained control of the town area. On the same day the airstrip was taken after heavy opposition. The Japanese also had to be cleared from Mount Api in order to secure the airfield; this task was undertaken by the 2/23rd and 2/24th Battalions.

"A" Company of the 2/12th Field Ambulance opened a rest station on the 7th; on the same day Colonel Littlejohn, Consulting Surgeon, arrived and gave great assistance. He was able to reassure the surgical teams that patients were arriving at Morotai in good condition.

An added difficulty in the current situation was that the roads were heavily mined, and unsafe for vehicles. Japanese were still very close to the medical units. In spite of the posting of picquets there was continued danger of infiltration by the enemy: this was emphasised when a Japanese placed a bomb under an occupied bed in the isolation ward of the M.D.S., killing the patient.

Active patrols of the 2/24th Battalion were pressing to the north towards the Juata oilfield with slight opposition, though the 2/48th Bat-

talion encountered resistance in the central sector near the area known as "Sykes", which was only a little south of the Japanese headquarters at Sesanip. South of Sesanip the 2/4th Commando Squadron also had sharp encounters with the enemy.

The M.D.S. of the 2/11th Field Ambulance now ceased to admit patients; instead they were sent direct to the 110th C.C.S., which was more favourably sited in the old hospital. The military situation was rapidly coming under control, but there were still hostile episodes and the enemy held on to some strongly defended positions. A sharp engagement by the 2/3rd Pioneers produced a number of casualties, seven killed and seventeen wounded. Bearers found the task of carrying in the wounded most difficult and exhausting. On the 12th a series of attacks from the south made little impression on the enemy, but strong air strikes, followed by a battalion attack, forced a Japanese retirement and on the 16th the 2/3rd Pioneers reached the east coast at Amal. Patrols were then able to penetrate as far as Cape Batu without opposition, and the greater part of the Cape Batu Peninsula was cleared of enemy forces.

The headquarters of the 2/12th Field Ambulance was now going back to Morotai, leaving the divisional rest station to be taken over by the 2/11th Ambulance, while all casualties went direct to the C.C.S. The work of the medical units was centring chiefly on medical as contrasted with surgical work, as casualties dwindled in numbers.

The military picture changed, and the 2/24th and 2/48th Battalions carried out wide flanking movements with the object of confining the Japanese force and isolating it from all tracks leading to Sesanip. Towards the end of May the enemy still showed strong opposition in their defended areas; there was also a temporary shortage of ammunition, but at the beginning of June strong air strikes lowered the Japanese morale, and, though counter-attacks were made, they met with no success. Patrols blocked the main escape routes which the Japanese were likely to use, for Intelligence learned that a break-out was to be expected on 8th June. Air attacks were planned to block this move, but bad weather prevented them; counter-attacks were made by the Japanese on the night of the 10th, but these failed. Captured documents had suggested that the Japanese designed to do as much damage as possible in their expected break-out assault, and in anticipation of the possibility of the 2/24th Battalion being cut off in the oilfield area, special medical precautions were taken. Major J. P. Lyttle and Captain L. H. McMahon were sent to establish a surgical centre at Juata but the need did not arise. By the 14th, patrols discovered that the enemy had already begun to withdraw from their headquarters area, and had prepared reserve positions towards Essie Ridge. This feature was promptly attacked from all directions, thus hindering the enemy from establishing new positions, and the 2/23rd and 2/24th Battalions advanced along the ridge.

A detachment of the 2/48th Battalion proceeded by L.C.M. to the mouth of Amal River; this was accompanied by a detachment of the 2/11th Field Ambulance, but activities were limited to patrolling. From

this point onwards the campaign was virtually over. The enemy was dispersed over a very wide area, and land and water patrols attacked numerous small parties. Some of these were killed, some were captured, and hunger drove others to return to their previous haunts where they were ambushed or surrendered. During July and up to the time of general capitulation the enemy forces on Tarakan were steadily reduced.

During these last weeks the medical units on Tarakan carried on with the usual handling of casualties. Fortunately these were few, though during May and early June when the Japanese were more pressing and active, occasional clashes produced more casualties. On 28th May more attention was called for on the Juata oilfield, where numbers of a dengue-like fever were occurring. This need was met by an A.D.S. sent by the 2/11th Ambulance. Colonel Morrow, Consulting Physician, had arrived on the 22nd and was of great assistance in the disposal and handling of medical cases. He initiated an enquiry into cases of unexplained eosinophilia among the troops. On the whole the health of the forces was good; malaria, dysentery and other infections were well controlled. On 31st May the hospital ship *Manunda* arrived and embarked casualties.

By 1st July the airstrip at Tarakan was effective, and air evacuation began, mainly of patients from the Balikpapan landings by the 7th Division.

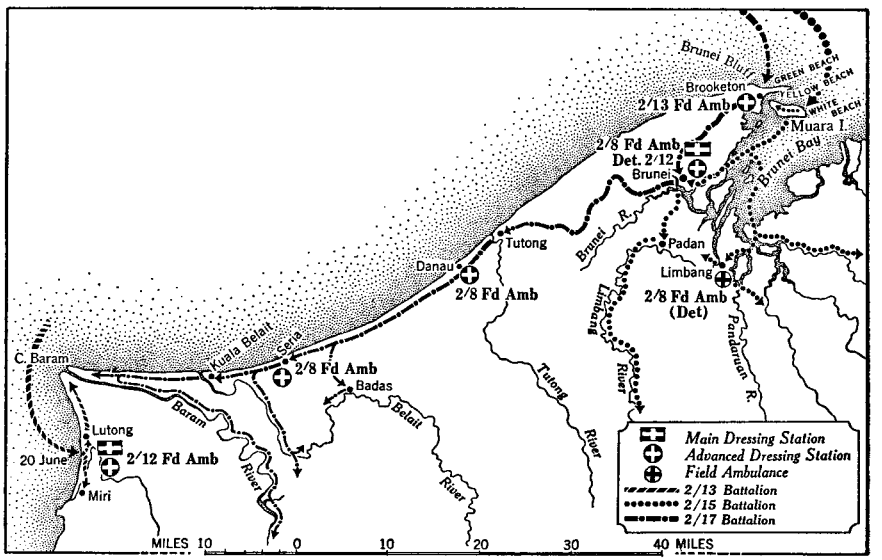
During July the operations on Tarakan were reduced to patrolling and general control measures, until the 15th August brought the collapse of the Japanese forces. The operations on Tarakan were of considerable intensity during the first active weeks, during which both the enemy and the Australian forces suffered many casualties. Australian casualties included 225 killed and 669 wounded; the enemy losses for the campaign as known were 1,540 killed and 252 taken prisoner.

BRUNEI BAY-LABUAN ISLAND

The second stage of the operations on Borneo, known by the code name of Oboe 6, was designed as a combined assault on Brunei Bay and Labuan Island, and was planned to take place in succession to the landing on Tarakan.

Topography. This area of north-western Borneo was particularly valuable for its rich resources of oil and rubber, and these natural advantages, together with its location and its possession of the best harbour along the north-west coast, made it most suitable for an advanced fleet base. The bay was thirty by eighteen miles in extent, and its entrances were commanded by the island of Labuan, with a town of some pre-war importance with port facilities at Victoria Harbour. Muara, another small island, lay off the mainland in the southern part of Brunei Bay; the town of Brunei, the largest in the area, was a few miles inland on the southern peninsula. The country along the coastline was flat and swampy; Labuan Island was hilly and covered with rain forest. There were several beaches suitable for amphibious landings in the area of Brunei Bay, and one on Labuan Island. Those selected were Brown Beach, near Victoria Harbour on Labuan Island, White Beach on Muara Island, and Green Beach on the

mainland at Brunei Bluff. A further beach was chosen, named Yellow Beach; its proximity to the waterfront at Brooketon with its wharves and jetties made it specially suitable for use in the maintenance of supplies. Plans made during April set the target date for the Brunei Bay operations on 23rd May, but lack of a serviceable airstrip at Tarakan and the time spent in assembling the assault force for Brunei at Morotai caused postponement. The final plan selected 10th June as Z-day, when simultaneous assaults would be made on Brown, White and Green Beaches.



These operations were assigned to I Australian Corps, which employed the 9th Division less one brigade. A rehearsal of the 20th and 24th Brigade Groups was held at Morotai on 31st May and 1st June, and on the following day a final conference was held of representatives of the three Services.

The convoy sailed from Morotai on the afternoon of 4th June, and covered the 1,100-mile voyage without incident. Preliminary mine-sweeping operations were carried out, together with sea and air bombardments, which were intensified during the week immediately preceding the beginning of the operation. The assault convoy arrived before dawn on 10th June and took up pre-arranged positions off the landing beaches.

LANDINGS ON BRUNEI AND LABUAN

After a heavy preliminary bombardment by naval and air forces, landings were made simultaneously at 9.15 in the morning on the three selected beaches, by the 20th Brigade on Green Beach, and White Beach and by the 24th Brigade on Brown Beach. The medical units assigned to the Brunei operation were the 2/8th Field Ambulance, commanded

by Lieut-Colonel Refshauge, a detachment of the 2/13th Field Ambulance, a small detachment of the 2/12th Field Ambulance, and the light section of the 2/1st C.C.S.

MEDICAL ARRANGEMENTS

"B" Company of the 2/8th Ambulance landed with the 2/17th Battalion on Green Beach. Arrangements were made for any early casualties to be transferred to L.S.I. *Kanimbla* by L.C.V.P., but the landing was unopposed. "A" Company of the same ambulance landed with the 2/15th Battalion at White Beach on Muara Island, here too there was no opposition. The 2/17th Battalion secured the beachhead at Brunei Bluff and later in the day began to advance along the road to Brunei town.

On the following day the advance continued with slight resistance from small parties of Japanese. The M.D.S. of the 2/8th Ambulance landed on Yellow Beach and was established in the Brooketon area. The headquarters of the 2/8th Ambulance set up in a building in a flat grassy area among palms and rubber trees. The Senior Medical Officer was assured by brigade headquarters that the M.D.S. staff and stores would be in the first landings after the taking of Yellow Beach. Actually the M.D.S. was among the last landed, a delay that might easily have been serious. Medical arrangements were further consolidated by the arrival of the light section of the 2/1st C.C.S., and the setting up of a beach dressing station by the detachment of the 2/13th Field Ambulance, and the settlement of the 2/12th Ambulance detachment in the M.D.S. area. Very few casualties required attention, but large numbers of natives came in to the beach dressing station, and the section in charge established a native treatment centre in a native compound.

Light sections of the 2/8th Field Ambulance went forward with the 2/17th Battalion and the 2/15th Battalion when this unit came over from Muara Island. One company of the 2/15th Battalion crossed the Brunei River near the town, and advanced towards the Limbang River; its medical care was also given by the 2/8th Ambulance. On the 12th, Brunei town was captured and on the next day was cleared. It had suffered extensive damage by air attack and enemy demolitions: air spraying of the area with D.D.T. was begun on the 11th and this and other preventive measures were continued in the town after its occupation.

Casualties from Brunei were sent by road to Brooketon, but in some discomfort as the road was bad, and the journey to the M.D.S. took four and a half hours. The rapid advance was imposing some difficulty on evacuation of sick and wounded; movement from Muara was being made by barge from Yellow Beach. The A.D.S. of the 2/8th Ambulance was forward with the battalions. The 2/13th Ambulance had landed a detachment at Labuan as well as Brooketon, and casualties waiting evacuation to Labuan were thereafter cared for at the 2/13th Field Ambulance beach post. The light section of the C.C.S. in the Brunei sector packed, and was ready to join the remainder of the C.C.S., while the M.D.S. at Brooketon was closed on the 16th ready for movement to Brunei.

COASTAL ADVANCE FROM BRUNEI

By the middle of June the 2/17th Battalion was advancing swiftly by motor transport along the coastal road and reached Tutong without resistance on 16th June. This movement was an important corollary of the landing at the Brunei area, as on the occupation of the part of the south-western peninsula depended questions of supply of oil and rubber. On the 20th a force known as "Coconut" Force, comprising the 2/13th Battalion Group and the headquarters of a light section of the 2/12th Field Ambulance made an unopposed landing at Lutong.

The most striking medical feature of this movement was the condition of some 200 released Indian prisoners of war. More than half needed hospital attention, and in the words of the A.D.M.S. "their condition was pitiful. The main complaints were malnutrition and nutritional oedema, malaria, dysentery, helminth infection, beriberi and tropical ulcers of the legs, some of which required amputation."

Patrols of the 2/13th Battalion moving north made contact with the 2/17th Battalion patrols on the 27th at Cape Baram: other elements of the battalion occupied Miri, down the southern coast of the peninsula. When this movement was complete the area from Brunei to Miri was under control. Surgical attention was provided should any be called for in this sector; an A.D.S. was set up at Seria by the 2/8th Field Ambulance, and a surgical team was attached. Such arrangements were made necessary by the length of time which was needed to bring casualties from Tutong or farther down the coast.

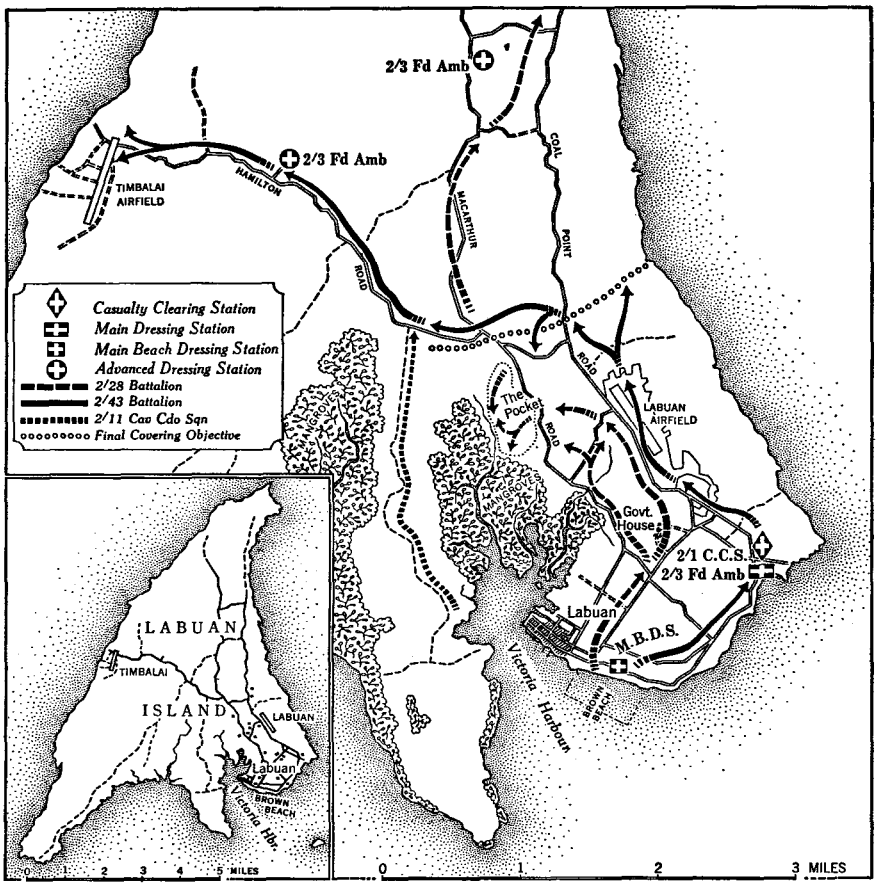
Meanwhile the 2/15th Battalion had been sub-divided: one company accompanied by the R.M.O., Captain F. A. L. Bacon, went to Padan experiencing only slight resistance; a second company was taken by landing craft to the Pandaruan River and occupied Limbang on 18th June. Small detachments of the 2/8th Ambulance supported these parts of the battalion. In view of the possibility of further Japanese strength existing in the Miri sector, the A.D.S. was brought farther back along the coast to Kuala Belait on 6th July and the M.D.S., having closed at Brunei, took over from the A.D.S. on the 14th.

The 20th Brigade was occupied with extensive patrolling from three main battalion bases, Brunei, Kuala Belait and Lutong. The 2/8th Ambulance was responsible for the Brunei-Kuala Belait sector and the 2/12th Ambulance for the Miri-Lutong area. A post was established at Baram River by Captain L. G. Redgrave, and on the 18th three battle casualties were received from the 2/17th Battalion. Evacuation along the coast was on the whole simple, as both sea and land routes were practicable; from most areas casualties were transported by barge and distances imposed considerable delay in some places.

By the end of July the position was static. The medical arrangements were always adequate for the requirements, and could have coped with much greater tasks if necessary. In the 20th Brigade there were only thirteen battle casualties, forty-seven sick and twenty-five non-battle injuries.

LABUAN ISLAND

The site selected for the landing on Labuan Island, Brown Beach, in Victoria Harbour was the only practical choice, since it was the only beach free of reefs. Full discussion and rehearsal prefaced the landing, and the order of battle provided for 29,361 troops. The plan was that the 24th Brigade should land on Labuan on a two-battalion front, with the 2/43rd Battalion on the right and the 2/28th Battalion on the left. The 2/13th Battalion was the brigade reserve and the 2/32nd Battalion remained afloat as a divisional reserve.



Naval and air support was provided for Labuan as for other landing areas, and preliminary bombardment was arranged for 10th June.

The task assigned to the 24th Brigade was the capturing of Labuan airfield, and a covering position to the north. This airfield was one of two on Labuan, the second was at Timbalai on the west coast north of the main settled areas. The 2/43rd and 2/28th Battalions were each accom-

panied by a section of the 2/3rd Field Ambulance; both battalions made an unopposed landing. Owing to successive arrivals on Brown Beach there was some congestion on the beach, but the 1st A.A.M.C. Company Beach Group set up a main beach dressing station. The two battalions advanced by roughly parallel roads towards the Labuan airstrip, with the 2/43rd on the right flank. On this flank the resistance was very slight, but the 2/28th Battalion met determined resistance in the Government House area. There were a few casualties in this unit; they were evacuated by the beach company to the L.S.I. *Manoora* and *Westralia*. During the first twenty-four hours after landing and before an M.D.S. was established, evacuation to L.S.I. was found a valuable measure; so too was the placing of a surgical team on board for treatment of battle casualties during the first day. As the troops approached the airfield stronger opposition was encountered from the Japanese. By evening the airstrip was captured, though the 2/43rd Battalion was still under enemy fire from the western side.

The 2/28th Battalion sent a company to clear Labuan town, and advanced to the north-east less than a mile, when enemy fire caused a halt. The support of tanks enabled the troops to take the area eastwards to Coal Point Road, which ran to the north past the airfield. Further attempts to advance to the north evoked strong resistance. Next day this objective was gained without trouble, and the 2/28th Battalion advanced on two parallel axes west of the airfield. The going was difficult, but the columns made contact on a cross track and when evening closed down they confronted the Japanese in strongly defended positions.

MEDICAL ARRANGEMENTS

While the 24th Brigade was advancing, the 2/1st C.C.S. and the 2/13th Field Ambulance landed, and after spraying the area, set up an M.D.S. in a native hospital. On the 12th, patrols of the 2/43rd Battalion found strong enemy pockets along MacArthur Road, which ran north past the western lines of the 2/28th Battalion. The 2/43rd Battalion outflanked one strongly defended locality, and while one company with tanks dealt with this, pressed on to the north towards the Timbalai airfield, making contact with the 2/11th Cavalry (Commando) Squadron which had moved up from the coast opposite Victoria Harbour. The result of these manoeuvres was to encircle the enemy's main defensive line, thus keeping him contained while the rest of the island was cleared. The Timbalai airfield on the west coast was an important objective, against which the 2/43rd Battalion was employed while the 2/28th Battalion was engaged in pressing on to the northern tip of the island. The Japanese north and west of Labuan airstrip had meanwhile been concentrated in an area known as "the pocket", which could be dealt with by the two battalions once the Timbalai airfield was fully under control.

Medical cover for these operations was given by a section of the 2/3rd Field Ambulance, supporting the 2/43rd Battalion, while another section was assigned to the 2/28th Battalion. Evacuation to the main beach

dressing station was carried out by the 1st A.A.M.C. Beach Group. On the 11th the M.D.S. began to receive and hold patients. A surgical team was installed at the M.D.S. supplemented by another team from the 2/1st C.C.S.

The 2/1st C.C.S., under command of Lieut-Colonel R. G. Worcester, after landing on 10th June, had gone inland but were unable at first to reach the staging area as this was under fire. A week later the unit took over a site from the 2/3rd Field Ambulance, and on the 16th a rush of casualties kept the unit busy for some hours with help from Major D. C. Sword of the 2/6th A.G.H. surgical team. Over 150 patients had been admitted since midnight. The splitting of the C.C.S. into its two sections was regretted by the staff; it did not favour efficiency in spite of the willing help of other units. Numbers of recovered Indian prisoners of war were admitted with infections, malnutrition and tropical ulcers.

Air evacuation to the base was possible and three severe battle casualties were returned to Morotai by Catalina flying boat; two men with head injuries and one with a compound fracture of a thigh. In the assault waves landed at Brooketon with the 20th Brigade was "A" Company of the 2/13th Field Ambulance, this part of the unit formed a beach dressing station.

Once the general control of Labuan Island was gained two other objectives remained, the disposal of the enemy in the pocket, and the carrying out of landings on the mainland to the east of the island. The pocket was an area some 1,200 by 600 yards, consisting of wooded spurs surrounded by swamps. From 13th June intense bombardments were carried out from land, sea and air, and three days later a company of the 2/28th Battalion with tanks gained a dominating position, commanding all approaches. The enemy resisted attack for three more days, and on the 20th two parties of Japanese tried to escape, but most of them were killed. Heavy attacks on the next morning destroyed most of the defenders of the pocket. The Japanese lost over 100 in this action, and had suffered 389 casualties since the landing, while the 24th Brigade Group lost 34 killed and 93 wounded. On the 15th, the M.D.S. in dealing with casualties from the 2/28th Battalion unexpectedly admitted twenty-five battle casualties in a short time. The next day the A.D.Ss. moved forward and the M.D.S. was handed over to the 2/1st C.C.S.

Landings at Mempakul. Another landing was made on the 19th at Mempakul on Klias Peninsula on the mainland across the East Channel from Victoria Harbour. The 2/43rd Battalion and attached cavalry, known as Scarlet Force, was accompanied by "B" Company of the 2/3rd Field Ambulance which established an A.D.S. after the unopposed landing. Evacuations were made from here to the 2/1st C.C.S. on Labuan.

Moves to Weston and Beaufort. On the 23rd the 2/43rd Battalion advanced overland in the direction of Beaufort. Another section of the ambulance moved in support of this battalion, and the next day "A" Company embarked with a surgical team on an L.C.M. via Weston and Padas River. This part of the unit proceeded up the Padas River and



(Australian War Memorial)

Beach Dressing Station, 2/8th Field Ambulance on Z-day, White Beach, Muara Island.



(Australian War Memorial)

The M.D.S., 2/8th Field Ambulance, Brooketon, Brunei Bay.



(Australian War Memorial)

A stretcher case being moved back to the R.A.P., 2/43rd Battalion, Beaufort, by hand trolley on the railway line.



(Australian War Memorial)

Casualty from Beaufort being brought down to L.C.M. for evacuation.



(Australian War Memorial)

Infantrymen who were wounded in the final mopping up operation on Labuan Island receiving medical attention on ambulance jeeps at a roadside clearing station.



(Australian War Memorial)

Adjusting patient's Thomas splint during operations on Labuan.



(Australian War Memorial)

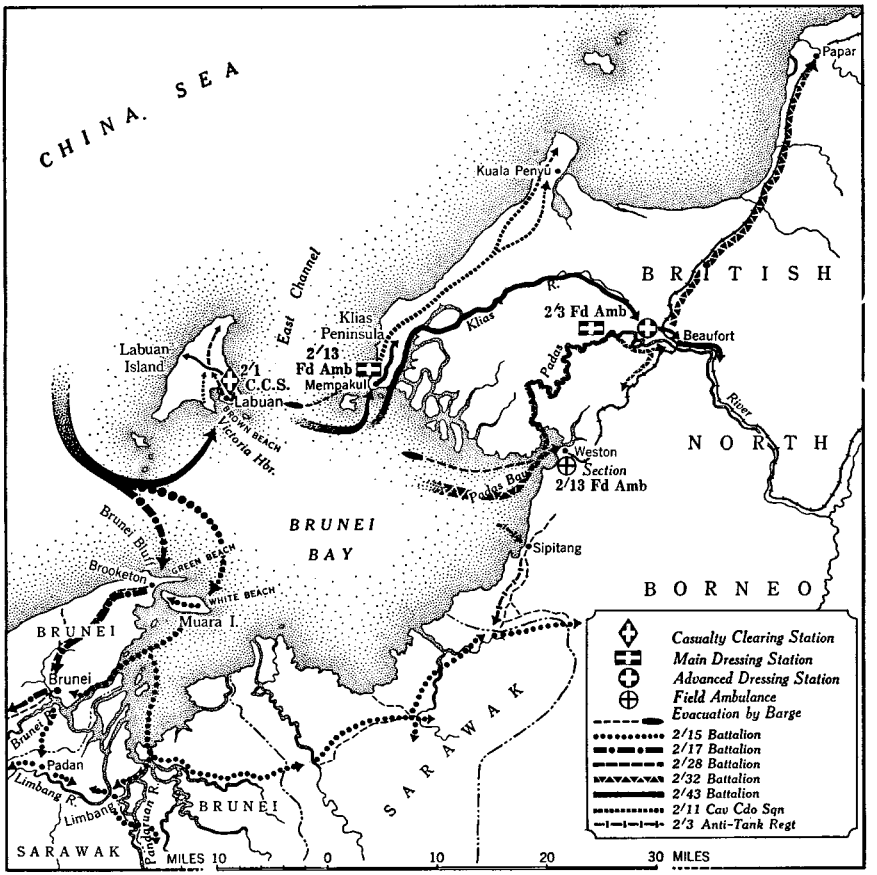
A tank driver, wounded in the advance west of Labuan airstrip, is carried back by stretcher bearers.



(Australian War Memorial)

Treating a stretcher casualty from the 2/43rd Battalion at Beaufort, north-west Borneo.

on the night of the 27th-28th the surgical team was very busy dealing with patients needing resuscitation and surgical measures. During this night and the succeeding day thirty-three battle casualties were dealt with.



An ambulance barge took patients back to the 2/1st C.C.S. at Labuan. On the 30th the M.D.S. was to move to Beaufort, leaving a small detachment to care for wounded men unfit for further immediate movement. These general moves illustrated the value of a field ambulance carrying D.D.T., as immediate occupational use of buildings was secured by prompt spraying.

After Beaufort was captured the enemy began to withdraw in small parties, many of which were destroyed either as they attempted to infiltrate past the company positions or by tanks sent up during the night. Further attacks with artillery disorganised the enemy who withdrew into the hills. The M.D.S. of the 2/3rd Field Ambulance moved into Beaufort, a settlement of industrial importance, and on 6th July a detachment of this ambu-

lance accompanied the advance of the 2/32nd Battalion into the village Papar along the railway line.

From this base patrols continued to discourage further activity along the river and to the north. A detachment of the 2/13th Field Ambulance set up an A.D.S. at Papar, and the position remained static. From Papar to Miri all the important portals of entry were now under Allied control, and the 9th Division's assignment in Brunei and Labuan was fulfilled.

Medical Work on Labuan

The medical units still had some work to do, and for the purpose of an occupation force had plenty of assistance. The 2/4th A.G.H., under command of Colonel T. G. Swinburne, went on from Morotai to Labuan on 16th June to select a site. On 5th July their nurses and physiotherapists joined the unit and on the 16th the hospital opened for patients. On 2nd August Littlejohn visited the unit and saw in consultation several men seriously wounded: there were then over 100 patients in hospital.

The 2/6th A.G.H. arrived at Labuan Island on 10th July, and the site was being developed on 9th August. Before the hospital could admit patients on the 27th the Japanese had capitulated.

Meanwhile in the hospital area the 2/1st C.C.S. had been working on: their nurses had arrived by air from Morotai on 26th June, but even with this help it was a relief to the unit on 5th July to send back 163 patients by the hospital ship *Wanganella*. The help of nurses of the 2/4th A.G.H. who arrived on the hospital ship was welcome. Early in July the commander moved out to a camp hospital at Timbalai. The number of coloured patients admitted and held was increasing: the white patients were transferred to the 2/4th A.G.H. or discharged.[1]

When the news arrived of Japan's surrender the C.C.S. received instructions to expand to a bed state of 400, foreshadowing the return of prisoners of war from the eastern zone, to care for whom the 2/14th A.G.H. was being sent to Singapore.

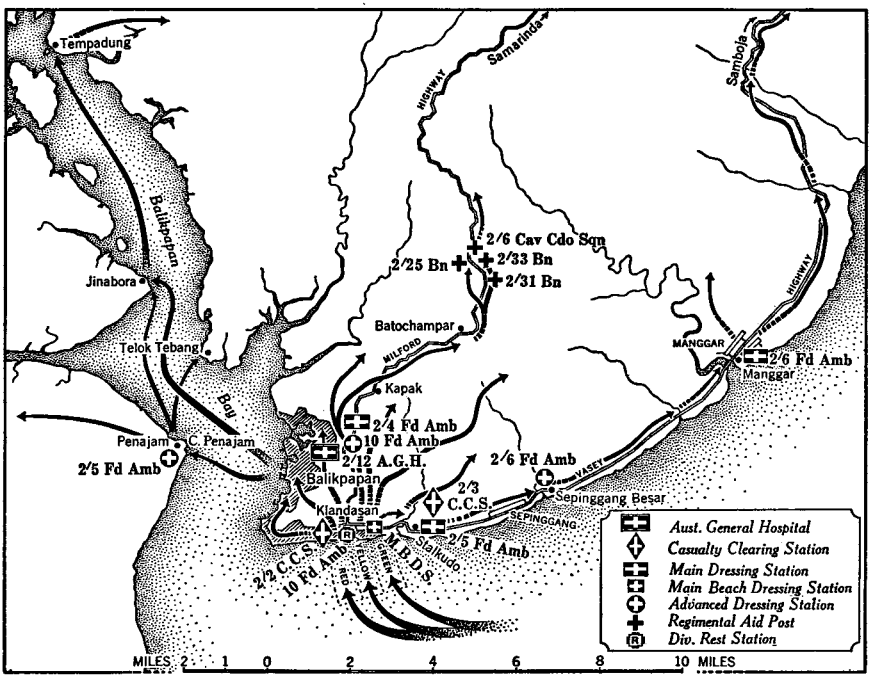
BALIKPAPAN

The final plan for the operations on Borneo assigned the landing on Balikpapan to the 7th Division. The code name for the operation was Oboe 2. Some delay could not be avoided in confirming a target date, but General Headquarters issued the operations instructions on 7th May, and in these set the date at 28th June. The movement of the 7th Division was authorised under the command of Major-General E. J. Milford. The 26th Brigade at Tarakan constituted the corps reserve for the operation, and arrangements for the landing at Balikpapan presumed the airfield at Tarakan to be then in working order.

Topography. The operations centred round the large and important oil refinery centre of Balikpapan to which oil was conveyed in pipe-lines for refining, and also from Java and elsewhere. The coastal plain was narrow,

[1] Australian casualties for Labuan and Brunei Bay areas: killed in action 9 officers, 105 other ranks; wounded in action 15 officers, 206 other ranks.

and the hills overlooking it rose steeply to 700 feet in height. Dense rain forest came close to the coastline and was intersected by rivers. Balikpapan Bay, consisting of several deep estuaries, afforded good anchorage. The



petroleum refineries were situated on the eastern side near the town of Klandasan, and were still in use by the Japanese before being destroyed by the preliminary bombardments. Near Klandasan there was one firm beach suitable for landing. There were two good roads; that known as Vasey Highway running along the coast, and Milford Highway traversing the hills. Two airfields were in the vicinity of the town area; the larger, Manggar, twelve miles to the east of the town; the smaller, Sepinggang, five miles from Balikpapan. Both were unserviceable from Allied air attacks, but capable of repair.

FINAL ARRANGEMENTS

Delays in movement of troops engaging in the Brunei operations affected also the naval units, especially cruisers and mine-sweepers, as these were needed for preliminary support in the Balikpapan action. Consequently General Headquarters set the final date of the assault at 1st July, and additional sea transport units (L.S.T.) were allotted to the force concentrating at Morotai where a rehearsal was held on 24th June. Two days later the 950-mile journey from Morotai to Balikpapan began. As in other amphibious operations preliminary mine-sweeping, sea and air bombard-

ments and underwater demolitions were carried out as a prelude to the assault. At the last minute it was found possible to include the reserve brigade and a reduced number of R.A.A.F. troops in the assault force, this brought the total on the order of battle to 33,446 men.

The medical units free to partake in this action comprised the 2/4th, 2/5th, 2/6th and 10th Field Ambulances, the 2nd A.A.M.C. Company Beach Group, the 2/2nd and 2/3rd C.C.Ss., 2/12th A.G.H. and 23rd Malaria Control Unit.

Landings. The assault landings began about 9 in the morning of 1st July on the beach between Klandasan and Stalkudo, sections of which were divided and were known as Red, Yellow and Green Beaches. The 21st Brigade under Brigadier I. N. Dougherty and the 18th Brigade under Brigadier F. O. Chilton landed simultaneously with one battalion forward on Green Beach, and two battalions on Red and Yellow Beaches. The task of the 21st Brigade was to advance coastwise along Vasey Highway to seize the Sepinggang and Manggar airfields. The 18th Brigade was to seize the high ground, destroy the enemy in the town, and free the harbour for early use. The first assault wave landed on all beaches simultaneously; the landing was unopposed. By the end of the first day most of the high ground overlooking the beachhead was under control, but the 18th Brigade encountered strong resistance north of Klandasan.

MEDICAL ARRANGEMENTS

When the assault troops landed, the surgical team of the 2nd A.A.M.C. Beach Group began work at the main beach dressing station, under Major C. D. Donald, relieved and assisted by Major H. B. Gatenby. Half of the light section of the 2/2nd C.C.S. helped with these arrangements, and part of the bearer company of the 10th Field Ambulance. There was no undue congestion on the beach.

On the following day the 25th Brigade landed to deal with the central sector, freeing the 18th Brigade for an advance north, and for over-water landings to the south. During the day the 2/5th Field Ambulance landed in small detachments and established an A.D.S. at the same site as the main beach dressing station. In addition dressing stations were ready for work on each beach. The 2/6th Field Ambulance, under command of Lieut-Colonel R. J. Humphery, also established an A.D.S. and this and other medical units found some difficulty in landing equipment and stores on account of the rough seas. Casualties were not held at the 2/6th A.D.S. but evacuated without delay to the main beach dressing station 1,000 yards away. There was adequate movement and no uncomfortable congestion on the beaches. On the second day Humphery, a commander of great experience, was accidentally killed; Captain R. J. Allsopp, R.M.O. of the 2/5th Cavalry (Commando) Squadron, had been killed in action on the previous day.

Opposition was encountered in some quarters, but on the third day less resistance was met in the capturing of Balikpapan town. "A" Company of the 2/6th Field Ambulance moved up the coast in support of

the 2/14th Battalion and the 2/3rd and 2/5th Cavalry (Commando) Squadrons. While "A" Company set up an A.D.S. at Stalkudo, "B" Company remained at a site near the beach area, and continued to collect and evacuate the casualties from the 2/16th and 2/27th Battalions. Anti-malarial measures were taken on the coastal strip by air spraying with D.D.T. from five Mitchell bombers.

On 4th July the 21st Brigade seized Manggar airstrip, while the 25th Brigade cleared the enemy from Klandasan. Many delays, some due to roadblocks and damaged bridges, were encountered along Vasey Highway when sending on casualties; as hitherto, all went direct to the M.D.S.

The rapid advance of troops with long distances between battalions made contact with the R.M.Os. difficult to maintain. A light section of the "B" Company of the 2/6th Field Ambulance moved up to the Sepinggang-Besar area. Casualties were light, but parts of the roads were bad and stretcher bearers had to be sent to jeepheads on damaged portions of the track to assist in transport.

The 2/4th Field Ambulance under command of Lieut-Colonel G. N. Young and the light section of the 2/2nd C.C.S. landed on the 7th, and on this day the 2/6th Field Ambulance opened its M.D.S. Meanwhile on the 5th, the 2/9th Battalion with "A" Company of the 2/5th Field Ambulance in support, moved over water from Balikpapan and landed on Cape Penajam, with artillery and tank support. An A.D.S. was established with a medical staging post through which casualties could be sent to Balikpapan by returning supply craft. Only one patient who was accidentally wounded needed treatment. Further unopposed landings were made later at Jinabora and Telok Tebang.

The 25th Brigade in its advance northwards towards Milford Highway at first met strong resistance, but overcame this and secured high ground near Kapak. Their left flank was covered by patrols of the 2/6th Cavalry (Commando) Squadron who made little contact with the Japanese.

Most of the patients admitted to hospital were not seriously ill, the commonest cause being upper respiratory tract infections; a few patients had pyrexia of unknown origin and there were only four cases of diarrhoea in the first week.

The L.S.I. *Kanimbla, Westralia* and *Manoora* arrived at the end of this week, and cleared the holding units on shore, taking twenty battle casualties and forty-two other transferred patients. The L.S.T. 777, equipped for surgical work, was enabled to clear its patients also. The 2/2nd C.C.S. opened for work on 8th July.

The 25th Brigade now went forward along the Milford Highway, towards Samarinda. Some strong opposition was encountered, but all was clear by the 9th. The next day more resistance was found at Batochampar where strong defences had been prepared by the Japanese, apparently for a final stand in this locality.

Patrols located strong enemy positions, and artillery concentrations were directed into these continuously for the next three days. The Japanese made many attempts to infiltrate company positions but were driven off.

On the 9th the enemy posts were found empty. The 2/33rd Battalion after sharp clashes found the enemy making further withdrawals. There was heavy fighting in the Batochampar area on the following day. The 2/6th Commando Squadron outflanked the enemy, and the 2/25th Battalion, relieving the 2/31st, repulsed them and inflicted casualties. In view of this strong resistance at Batochampar the forces were redistributed, and advance continued on both flanks despite heavy enemy opposition. Some of his well defended positions were captured and destroyed, and the enemy was almost encircled on the night of the 21st-22nd when he broke away and withdrew.

Medical cover was given by "A" Company of the 10th Field Ambulance till 18th July when the 2/4th Field Ambulance opened its M.D.S. and the unit stretcher bearers took over from the 10th Field Ambulance attached to the 25th Brigade R.A.Ps. A surgical team comprising Major Donald and Captain W. L. H. Keller from the 2nd A.A.M.C. Company Beach Group was attached to the M.D.S.

Further medical units had arrived. The 2/12th A.G.H. arrived on 14th July but did not open; the following day the 2/3rd C.C.S. opened to receive casualties. In the meantime an advance was being made up the Vasey Highway by the 21st Brigade, by first the 2/14th Battalion and on the 11th by the 2/27th. The 2/27th Battalion occupied Samboja on the 18th without meeting opposition. Patrols received information from native sources concerning Japanese troops to the north and the 2/16th Battalion was brought forward. A light section of "A" Company of the 2/6th Field Ambulance had accompanied the advancing force, but there was little work to be done. The "B" Company was engaged in preparing an M.D.S. at Manggar, and on the 21st it was open for patients.

Captain R. E. R. Gillespie and two O.Rs. of the "A" Company light section went to Samboja on the 22nd to investigate the general health, treatment and medical supplies for immediate needs of the natives. On the following day "A" Company closed its A.D.S. and moved to the M.D.S. area.

Meanwhile members of the Australian Army Nursing Service had arrived at Balikpapan on 27th July, both for the 2/2nd C.C.S. and the 2/12th A.G.H. Though flares of action had, during the latter part of this brief operation, given periods of intermittent activity to the field medical units, there was latterly, little to do. A certain amount of epidemic and seasonal illness occurred, and at the end of July some increase of malaria was noted, but not to a degree which caused anxiety.[2]

General Milford notified the 28th July as a rest day to mark the conclusion of the campaign: this was followed shortly by the conclusion of hostilities.

Medical units were provided on a generous scale for the Balikpapan landing. Most of the work was done by the field ambulances, including the medical company of the beach group. The larger units, comprising

[2] Australian casualties for Balikpapan: killed in action 23 officers, 206 other ranks; wounded in action 44 officers, 590 other ranks.

the 2/2nd and 2/3rd C.C.Ss. and the 2/12th A.G.H., did comparatively little, and the cooperation of the landing ships saved the field units from the necessity to hold an increasing number of sick as had occurred in other actions of more intense and prolonged type. It may be noted that the nurses arrived at the larger holding units within some two weeks of the units' opening. The most important aspects of the medical contributions to the taking of Balikpapan were those relating to prevention.

MEDICAL ASPECTS

Though each of the operations in Borneo had distinctive features, the medical aspects had much in common, for this campaign was part of the Allied "grand plan". From the medical point of view this was important, for large strategical enterprises like these produced a flow of ample resources of personnel, supplies and transport. The forces engaged in the "Oboe" operations thus had certain advantages, but even so, their sickness rates were encouragingly low. (See table page 398.)

Diarrhoeal disease. During these operations nearly 1,100 cases of diarrhoeal disease occurred, but there were no serious outbreaks. A minor epidemic began early on Morotai, but it remained mild and did not attain any degree of prevalence in the field. The type responsible could not be ascertained in about half the cases; this was probably due in part to the routine use of sulphaguanidine in aid posts, thus aborting the disease in many instances and making the organisms less readily viable in cultures when the patient was admitted to hospital. Some of these strains appeared to be resistant to sulphaguanidine, but responded to sulphamerazine. Amoebic infection was rare, and most of the attacks were clinically of the mild bacterial kind.

The standard of hygiene was high in most areas, and all ranks throughout the corps were well trained. At the end of 1944 the D.D.M.S. I Australian Corps, Brigadier Furnell, was able to state confidently that the troops had attained a high standard. This standard was maintained at a sufficiently high level during the landings and the development phase of the actions to prevent any outbreaks of dysenteric infection, but some casualties due to this cause were observed in well-trained units shortly after setting up camp in staging areas.

Lieut-Colonel C. E. A. Cook, Assistant Director of Hygiene at Advanced Land Headquarters, reporting on the hygiene of the force during the Borneo operations, showed that 80 per cent of such cases observed during June were traceable to the transit camp, where a high fly population was discovered in garbage dumps left or still in use by Allied troops.

Further inspection of the Morotai Details Depot Transit Camp during June revealed a highly insanitary camp, swarming with flies, with dumps of unburned organic waste. The latrines were defective and not fly-proof, and soil pollution had occurred. In spite of strong recommendations that immediate reconstruction of the area be undertaken, great difficulties were found in remedying basic defects, and the dysentery rate rose. Further

vigorous efforts secured improvement, whereupon the rate steadily fell. This was an example of the risks run by troops staged in an infected area in a base where important combined operations were being mounted.

Infective hepatitis was infrequent in the corps, a fact which may be directly related to the standard of hygiene and sanitation of a force. Only thirty cases were reported; one death occurred in a case in which there were severe complications. Strict isolation was practised with these patients.

Malaria did not constitute a danger, as only 218 cases occurred during the operational period. Less than half of these (97) were of primary origin, though most of these were of the malignant tertian type. Mildness was a notable feature of the clinical illness, and no serious complications occurred during the operations.

Malaria control. The low incidence was in itself good evidence of efficient control, though had the physical conditions during the actions been less favourable the results might not have been so good. The 2/3rd Malaria Control Unit and the 6th Army Mobile Entomological Section were attached to the 20th Brigade and found the discipline good, and anophelines few in number, though *Aedes* were plentiful. Dengue was expected, and this forecast was realised. Air spraying was not always satisfactory, in fact at Labuan it was called a "farce", since the aircraft flew too high and did not spray the maintenance area of the beach. Much D.D.T. was wasted in this instance and the need for good organisation between Services was apparent. It appeared that the Japanese had carried out some degree of larval control in places. Adult mosquito control was carried out by the control unit.

Dengue was reported in 413 men, but, as is usual, it was certainly more prevalent than was at first apparent, owing to doubts in diagnosis. The "dengue-like" illness seen in the early stages of the Tarakan landing was surely dengue in most instances. Colonel Morrow, who reported on the medical features of the Oboe operations, thought that the incidence was more probably about 600.

Mite-borne typhus did not appear during the early operations, but twenty-six cases occurred in all. Most of these were mild, though there was one death. The majority of cases could be traced to the airfield areas on Balikpapan, thus illustrating the well-known regional incidence of the disease. Care was taken in the application of miticide, dibutyl phthalate before troops entered suspected areas.

Ankylostomiasis was expected, but only eighty-one patients were admitted to hospital with this primary diagnosis, though routine investigation of patients in hospital for other cases showed that its actual incidence was widespread, though usually symptomless. Other worm infestations were also found.

Respiratory Infections. The comparatively high incidence of upper respiratory tract infections was an unexpected feature. Most of these infections came from Morotai, and pursued the force into the Tarakan, Brunei-Labuan and Balikpapan areas. Symptoms were usually seen in such epidemics, but there were no significant complications.

Skin affections were an important cause of invalidity as in other areas. Dyshidrotic dermatoses were a common cause of evacuation, and to a less extent, mycotic infections, especially of the feet. Of 17,555 admissions to medical holdings units 12.32 per cent were due to skin diseases, whereas only 1,543 battle casualties (9.19 per cent) were admitted.

It was observed that 21 per cent of men admitted for skin affections were sent back to the mainland; these conditions were responsible for more casualties and more evacuation to Australia than any other cause during the Borneo campaigns. Lichenoid dermatosis was not of statistical importance as a casualty producer, causing only 77 out of a total of 2,748 dermatological affections. A research plan was formulated in July for investigation of tropical skin affections, but when hostilities were concluded this could no longer be pursued. Up to that point general agreement was found with previous work done on dyshidrotic conditions, such as those found in *miliaria rubra*. As a temporary measure undue washing of the skin with soap followed by the use of powder was discouraged, and instead the application of animal fat such as lanoline was encouraged. X-ray treatment was available at the 2/5th A.G.H.: this was helpful in securing return to duty in numbers of men with skin affections.

Psychopathic disabilities caused a smaller proportion of illness than was originally expected. Only 360 patients were admitted to hospital, with a ratio of psychoses to neuroses of 1 to 4. About two-thirds of the psychotic patients were of the schizoid group and had to be sent back to the mainland, but good results were obtained by the use of convulsive therapy before moving them back to Australia. Prompt use of this measure appeared to have a favourable effect on the mental state and to have some influence in preventing mental deterioration. Fear and exhaustion states were well handled by the R.M.Os., especially at Tarakan.

In general the Borneo operations were a striking lesson in the value of preventive medicine and surgery. The use of beach groups as well as field ambulances gave wider scope in the handling of battle casualties, and surgical teams provided ample assistance. Difficulties in evacuation of sick and wounded occurred of course, for the tactical difficulties inherent in the landings were considerable where the operations were resisted by the enemy. Special care was taken to supply blood for resuscitation, and other supplies as a rule were adequate.

Native population. Special problems emerged in connection with the native population. Not only were they very dirty, and a hindrance to those working in the forward areas, but there were no satisfactory surgical facilities for treating them ashore. This difficulty was enhanced by the fact that casualties often first occurred among the natives; to meet this it was recommended that a unit should land early, with surgical equipment, and be experienced in the handling of natives needing attention. Keeping the troops away from these natives was in the interests of hygiene in general. During the Brunei operations a compound was established on shore between the beach group and the M.D.S. Medical arrangements were in the hands of a company of the 2/13th Field Ambulance. Though only

a few natives suffered battle casualties, their injuries were severe; two lost limbs. Beriberi was prevalent, and so too was yaws. The spleen rate was high, and dysentery was endemic. The natives whose condition was poorest were the Javanese, who were the victims of slave labour. The Chinese were fairly healthy. The health of the inhabitants was regarded as most important by the medical services, and on 4th August a medical survey was distributed to medical officers by the D.D.G.M.S. of Advanced Land Headquarters. This suggested that natives in compounds should be examined for malarial parasites and micro-filariae, and for organisms and worms parasitic in the alimentary tract. Anaemia, tuberculosis, pneumonia, frank vitamin deficiencies, tropical ulcer, yaws and venereal disease also demanded thought, and if necessary, investigation. A number of possible avenues of enquiry were mentioned, including the macrocytic and iron deficiency anaemias; it was pointed out that most of a recent group of Indian prisoners of war had haemoglobin levels below 10 grammes per cent. Medical officers were encouraged to initiate and pursue some line of clinical investigation among members of the indigenous population.

Stores. These were on the whole satisfactory. Where an advanced depot medical stores was set up close to the M.D.S. the arrangement was very convenient. Syringe packages for injection of morphine were not satisfactory: those of Australian manufacture were often faulty and could not be used. Drugs were in good supply, but at one time penicillin threatened to become scarce because of a strike of glass workers in Australia.

Blood and Serum. Daily supplies of thirty litres were sent by air to the Brunei-Labuan front; ten litres of this was ferried to Brunei by sea. The blood arrived in good condition, but some delay occurred in the return of empty box containers. Fuller supplies were planned, but were not required, as blood was obtained from local donors.

Surgical Work. Changes were rather in the means of organisation than in technical methods. Surgical teams were fully available, though sometimes the conditions favoured the sending on of wounded. In the past, treatment has been successfully given under sketchy conditions inevitable through the extent of time and distance. Nevertheless the difficulties imposed by amphibious landings did not necessarily invite primitive conditions. There are times to work and times to wait.

Colonel Lempriere, A.D.M.S. of the 9th Division, remarked in a report on Oboe 6 (Brunei and Labuan):

> Heroic surgery under a gooseberry bush at the moment of landing, with a flask of serum dangling from a rifle, is picturesque but unsound. Until reasonable shelter and protection ashore are assured, treatment is limited to the relief of pain and shock and the arrest of haemorrhage and immobilisation of fractures. Evacuation to ships equipped for major surgery covers the initial phase until medical units are fully established ashore.

He further remarked after this operation that the splitting of units does not always increase efficiency. Though it has its place it can be over-done, and separation of the sections of a C.C.S. reduces the value of the heavy component.

The landings in the Oboe 6 operations were completely successful. The simultaneous landings were preceded by bombardment, and landing barges followed the ships covering the assault area. Shore installations were destroyed and the buildings in Brooketon were razed.

Surgical facilities were set up on shore as quickly as possible: occasionally the lack of resistance caused unexpected speed of advance, necessitating changes in the medical plans. Advanced dressing station equipment was complete, and included jeep and trailer, making the set-up more elastic.

Existing buildings could sometimes be used as they were on Tarakan. For example, the 2/8th Field Ambulance sent its advance party in with a surgical team from the 2/4th A.G.H., and used tents and buildings left by the Japanese. In spite of delays in transit due to trans-shipping to barges and to shortage of wheeled transport on land, the M.D.S. was set up in a suitable flat dry area, with all stores to hand by midday on the day after the landing.

Problems of evacuation of sick and wounded. In general these problems followed the usual pattern with certain differences. There were self-contained medical units in strategic areas which were equipped to deal with casualties, and to hold them till further movement was possible. As has been seen, a number of the landings were unopposed, but the later occurrence of occasional severe casualties called on the resources of the units. In the Oboe 6 operations evacuation was simplified by the fitting of two L.C.M. to carry eighteen stretchers, and attaching orderlies who could follow up treatment and attend to seriously wounded men on their way to hospital. These barges carried some equipment, rations and limited comforts; they were roofed and reasonably weather-proof. L.S.M. were used for longer distances, but had somewhat primitive conditions. Further medical facilities were provided by the L.S.I., and designed for use during the assault phases. *Manoora* and *Westralia* carried three medical officers each, and *Kanimbla* two, and could accommodate sixty, sixty and twenty bed-patients and sixty, sixty and fifty ambulatory patients respectively. These facilities were valuable in the early stages of Brunei and other landings before arrangements for medical care were adequate ashore. Some specialist surgical help was available in U.S.S. *Rockymount,* and there were also seven L.S.T., each with two or three medical officers and seventy-five beds.

From R.A.P. to A.D.S. At first patients were moved by stretcher bearers; and later, when advance had been made, by jeep ambulance. A.D.Ss. were established by light sections of a field ambulance company, each of which consisted of one medical officer, one bearer officer and twenty-four other ranks. On occasion, as at the landing on Green Beach on Brunei, there were no casualties, and the S.M.O. of the area decided not to unpack the A.D.S., but to let it move with the battalion with a jeep and a trailer. The equipment of each light section of a field ambulance company was carried by the personnel when on the assault scale, when the total weight was 460 pounds. The full scale with jeep and trailer

allotted to the main body of the company weighed 1,000 pounds. The assault scale provided equipment sufficient to treat 100 patients with a re-supply for two days. Coverage consisted of four 12 x 12 ground-sheets when available.

From A.D.S. The arrangement was that till the evening of the day of landing evacuation was to be direct from the A.D.S. to sea with L.C.V.P. to L.S.I.; during the night the A.D.S. would hold casualties or send on to the M.D.S.

From M.D.S. Road Evacuation. Jeep ambulance plied to the beach post; this was the method used in general for road evacuation. The patients found it comfortable though slow: on Klias Peninsula it took two hours to go nine miles owing to the sandy nature of the track, which was badly cut up by tanks.

Seaward evacuation. Four L.C.V.P. were available to run from Green Beach to L.S.I.; this worked well, the casualties were well looked after and congestion at the M.D.S. was relieved. Ferrying could not be done at night as the channels were too difficult. Of course the time possible for a L.S.I. to remain, depended upon the degree of enemy opposition. At Brunei and Labuan they remained till the afternoon of the day following the landing. Seaward movement of casualties was carried out by assault shipping where possible, and on 5th July the 2/2nd Australian Hospital Ship, *Wanganella,* arrived, and left the same day carrying 162 Australian, Indian and Allied sick and wounded.

Air evacuation was very satisfactory when practicable, but some delays and cancellation of aircraft were unavoidable owing to bad weather.

The outcome of the medical arrangements was very satisfactory. Even with the advantages of these well-wrought plans, the amphibious landings on Borneo were intricate in details, and involved a number of assaults by sea, air and land, and the occupation of some 200 miles of difficult country. Extemporisation was still of value: delays occurred due to lack of prompt transport, or to the problem of catching up with over-rapid advance, or to activity of the enemy. Such matters could be dealt with by experienced field units. Different and more subtle of value were the blessings of preventive medicine. Morrow in reporting on medical aspects of the operations said:

> This campaign has been a tribute to preventive medicine. In a force which was never below 70,000 in strength the total number of admissions to all medical units during the five month period under review was approximately 17,000. The highest admission rate from all causes other than battle casualties was 14.3 per 1,000 per week.

The greatly reduced figures for diseases such as malaria, dysentery, typhus, dengue, and other infectious diseases, endemic and otherwise, represented a major advance in the saving of manpower. It must not be assumed that the medical services can take all the credit for this achievement, or that the combatant troops should not be credited with their good training in manner of living. Yet the medical services are responsible for the

standards set and maintained if health is to remain with a force living and fighting in the tropics.

AFTER CESSATION OF HOSTILITIES

Finally it should be noted that while cessation of hostilities put a term to much of the medical work with the forces, it also imposed further responsibilities in the care of prisoners of war of several nations. The professional calls were many to relieve the tragic condition of hundreds of these unfortunate victims of war, and on many fronts these victims of physical damage and spoiled metabolism were freely entrusted to the zeal and care of the medical services.

The medical problems of diagnosis and treatment often called for careful clinical and pathological investigation and other ancillary methods. In chronic infective states, such as dysenteric infections or tuberculosis, the interests of other potential or actual contacts had also to be studied. Amoebiasis, chronic malaria and other vector-borne tropical diseases had to be considered as possibilities, and tropical ulcers might require even drastic surgical treatment.

States of disordered metabolism and dietetic deficiencies often presented difficulties both of diagnosis and handling, and various degrees of starvation often demanded great care in feeding. Special instructions were compiled and circulated dealing with the requirements of ex-prisoner patients; these indicated the diagnostic methods which might be valuable, and gave directions for feeding patients with present or suspected defects of assimilation.

Many variants of vitamin deficiencies were seen, and in some instances required special investigations. Nutritional oedema required biochemical study; special examination of the cardio-vascular system, and the blood, and of the sensory functions were sometimes called for; in particular the existence of nutritional amblyopia was of great importance.

Many of these patients could be passed on to base hospitals on the mainland for fuller investigation, but it was desirable that the pathological bases of these conditions should be early understood. When numbers of repatriate patients were admitted for observation and treatment in a short space of time considerable work was cast on the medical and nursing staffs. This was particularly true of the keeping of medical records, since many of these patients were drawn from the armed Services and would probably require the surveillance of the Repatriation Department. These duties sometimes delayed the closing of medical units, and added to their administrative burdens for a time, but, as might be expected, this work attained a high standard of skilful and assiduous attention. In addition, a certain proportion of medical personnel were required for the routine care of troops still carrying out a defensive role. As far as possible length and type of service were considered in the release of members of the medical corps, and the usual principle was observed that consideration must be given to the patient first.

ADMISSIONS TO MEDICAL UNITS 6th APRIL-7th SEPTEMBER 1945

Admissions	Morotai Area	Tarakan Area	Brunei-Labuan Area	Balik-papan Area	TOTAL ALL AREAS
DYSENTERY					
Clinical	167	37	82	86	372
Bacillary	103	10	19	3	135
Amoebic	6	2	5	5	18
Enteric	4	—	—	—	4
Others	180	101	151	107	539
Whooping Cough	1	—	1	—	2
U.R.T.I.	1,011	109	221	231	1,572
T.B.	5	1	—	1	7
Influenza	—	—	—	1	1
Pneumonia	16	1	5	3	25
MALARIA					
Primary:					
B.T.	1	3	18	21	43
M.T.	1	—	33	17	51
Others	2	—	1	—	3
Subsequent:					
B.T.	21*	20	15	22	78
M.T.	1*	—	3	32	36
Others	5	1	—	2	8
Dengue	28	70	229	86	413
Typhus					
Endemic	1	—	1	24	26
Glandular Fever	1	—	—	—	1
P.U.O.	412	242	365	415	1,434
Skin Diseases	1,075	397	859	417	2,748
Battle Casualties	—	718	218	607	1,543
Non Battle Injuries	557	198	343	429	1,527
V.D.	17	—	19	1	37
Ankylostomiasis	1	41	30	9	81
Measles	4	—	—	—	4
Mumps	5	—	—	—	5
C.S.M.	—	1	1	2	4
Infective Hepatitis	9	2	7	12	30
Brucellosis	1	—	—	—	1
Weil's Disease	—	1	—	—	1
All other diseases	2,449	871	1,368	1,202	5,890
TOTAL ALL CAUSES:	6,084	2,826	3,994	3,735	16,639

Note: * Mixed Infection.

EPILOGUE

THE brief quotation from Amiel's *Journal Intime* which stands at the beginning of this volume sets up as an ideal of life triumph over sickness of body and spirit. This constant assertion against the forces that threaten to destroy us may be applied with some realism to the struggle of a military force against a dangerous enemy in a hostile environment, but it is not enough. Amiel, though a poetic observer of the scene of life, was not a man of action, and despite his clear perception of the risks of "annulling or dispersion of our physical and moral being" he could produce no sure guide from his life as a didactic philosopher.

The struggle to overcome, and, more important, to prevent the dangers of injury and infection in a tropical campaign has been a leading theme of this book. We have seen that here is a need greater than a mere passive act of living; action is needed, and action on a scientific basis which appeals to the medical services. Only constant striving can prevent those slips that perpetuate infectious diseases, especially those associated with the tropics, and it is the incessant application of the practice of medical science that preserves a force and makes possible the triumph of which Amiel speaks. Indeed it is the narration of these doings, the daily service of the doctor in the field, which fills a gap in the teaching of the moral philosopher.

But we must touch a little deeper. The last phase of the operations whose medical story we have followed was that of liberation, and thrilling though this reward was, even liberation is not enough unless it leads to freedom. Further, the task of releasing fellow men from bondage is not the whole end, for this is concerned with an individual freedom such as the famous four freedoms. We cannot here discuss self-determination in the light of national action, but we are concerned with all that is implicit in its gift to every man. In order that men may be made free of serious illness of body or mind it is necessary that they be led to follow the way of health, free from the bonds of selfishness or ignorance. Every man has his own personal responsibility, but this varies in importance and in the understanding with which its ideals are transformed into action.

The work of an army is carried out by a chain of responsible persons, many of whom, particularly in the medical formations, are surprisingly youthful. Even superficial study of the work of young medical officers will reveal a remarkable ability to accept and use responsibility with courage and tolerance. Responsibility is a jealous privilege of the medical profession; it is essential for the maintenance of the closest relationship between the sick and the healer. The guarding of this privilege is necessary, for in the past and during recent times legal judgments have placed some restriction on this particular freedom, though as it has been pointed out, "the quality of medicine will suffer by every diminution of the doctor's responsibility".[1] Organised medicine has tended to encroach on

[1] *British Medical Journal*, Editorial, 31 July, 1954, p. 290.

this privileged duty, and perhaps the reaction of those who practise medicine is natural. One outstanding feature of military administration is that of delegation, a form of action which may be utterly sterilising if poorly conceived and carried out, but which may richly reward its intelligent use if responsibility be delegated with both hands when the need arises. The value of independence of spirit, and loyalty of purpose may be seen in medical work under action conditions, for these qualities are not incompatible, and are equally desirable in time of peace.

The medical profession in Australia has brought forth a number of distinguished members who have made many noteworthy contributions to medical science as studied in the tropics. The problems of the tropical areas of the world are many and great, and Australia must bear her own increasing share. Opportunity stands waiting today and many specialised workers are needed. Australia could not have been made safe in the years of war without the toil and effort poured out on the field of battle, and the medical workers played their part in those technical labours which did much to mitigate losses of life and of the ability fully to live. It must be realised too, that the practical action which inspired medical work in the Pacific Islands was not based merely on a desire to benefit our own people, for the claims of those peoples indigenous to the country were beyond question.

To ideals, then, we must add action: the flame of health of body, mind and spirit must be tended and kept aglow; our corporate and individual safety depend upon it. The hand that seizes responsibility and uses it as an unselfish weapon is the hand that gives freedom.

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